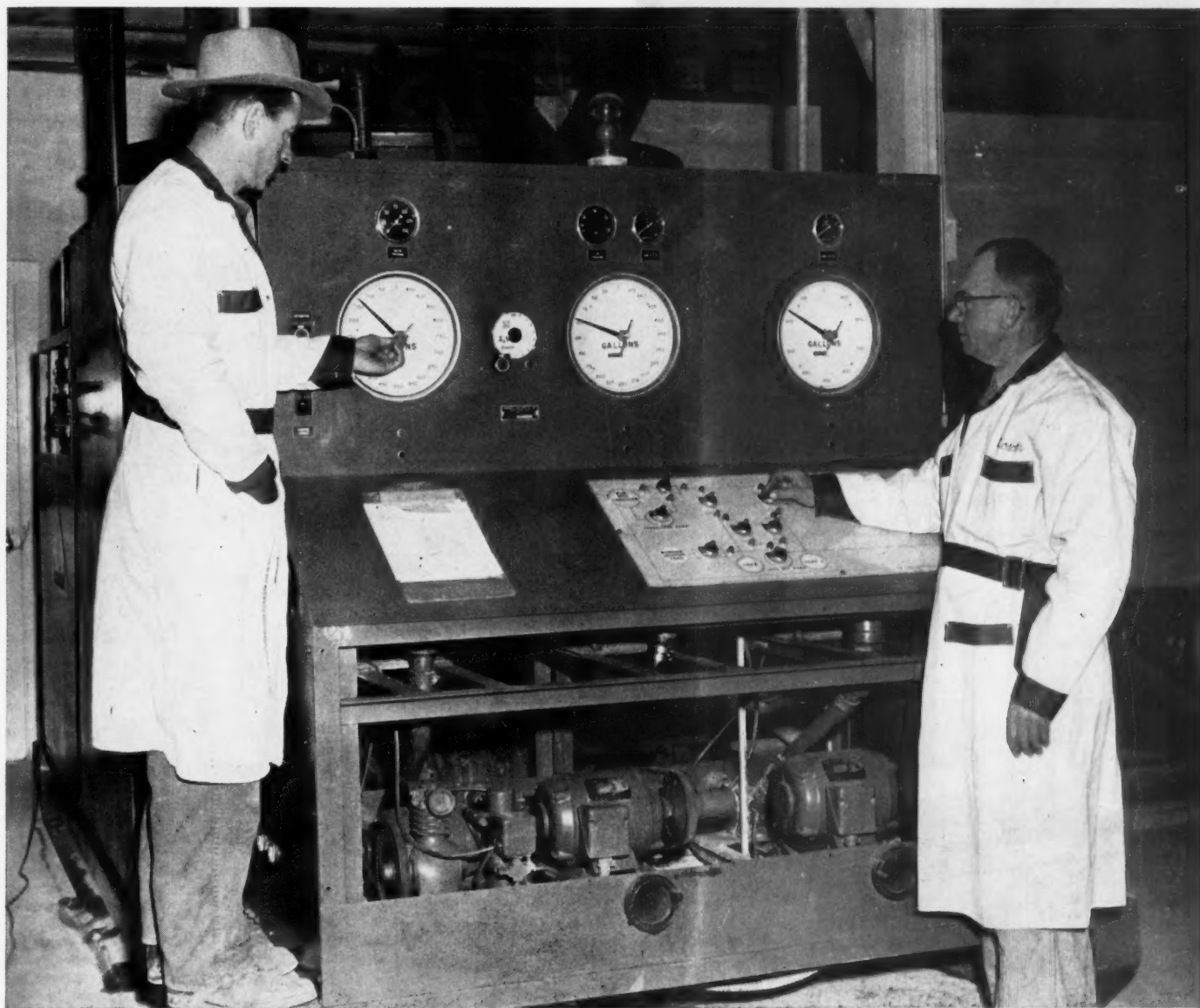


PRODUCTION EDITION

for Manufacturers of Chemicals for Agriculture



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LIQUID FERTILIZER OPERATION—Control center for operations of Land-O'Nan liquid fertilizer plant at Morganfield, Ky. Ed O'Nan, owner, left, with Gordon Martin, plant manager. See story, page 4, this issue.

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Intensive Studies Overcome Instability Problem in Methyl Parathion Dust Product

A PROGRAM directed toward finding an effective means of stabilizing methyl parathion when formulated on inert carriers has been under way by Monsanto Chemical Co. for the past more than two years. This project has led to discovery of an additive composition which the company says greatly increases the stability of the toxicant in dust formulations.

Following is a discussion-report of laboratory investigations on the stability of methyl parathion, one of a group of organic phosphates whose properties include thermal instability. Conditions involving high temperatures (90° F. and higher) often exist during handling and storage of finished dusts which can lead to complete breakdown of the toxicant. This is especially true throughout the Southern states where such dusts are used in great quantity.

So-called "inert carriers" may not be as inert as the term implies. In general, the tales were found to be the least active and gave the most stable formulation. This order of activity of the carriers is the reverse of their absorbent characteristics.

Degradation of methyl parathion in dust formulations is due primarily to thermal instability and carrier activity rather than to direct hydrolysis. Hydrolysis is the result of excessive moisture or alkalinity. Such conditions are not likely to be encountered with commercially available carriers.

A number of different analytical methods are in use by the various producers of methyl parathion, the regulatory agencies and independent laboratories throughout the country. These methods include the official AOAC nitrate titration, total hydrolysis, polarography, and the use of ultraviolet and infrared spectrophotometric methods.

All of these methods have different degrees of precision and accuracy. There seems to be a complete lack of standardization between all of the interested parties. This means that material may be produced and sold on the basis of any accepted method

and later come under the regulatory action of agencies employing totally different methods of analysis. These practices could lead to complications unless full accounting is made for the differences in procedures.

Where dusts are concerned, it was determined that losses from field strength dusts or concentrates are independent of the initial concentration. The absolute losses in either case would be about the same when subjected to the same set of conditions. The percentage loss from a concentrate would be much less than from a field strength product even though the same absolute amount was involved. This one fact is the greatest obstacle in the satisfactory stabilization of methyl parathion dusts. (See figures.)

"Deactivation" of the inert carrier has proven partially successful where chlorinated hydrocarbons are concerned. Other means have been employed to increase stability of vari-

EDITOR'S NOTE

The problem of instability of organic phosphate dusts and steps taken to correct the situation are covered in this article. Monsanto Chemical Co., St. Louis, reports that the situation was first brought to its attention during the 1955 season when isolated instances of low assay material were reported. By 1958, reports of degraded material became rather frequent, the company reports, with the situation culminating in a "cease sale" order in Louisiana that year. The order was revoked later after major formulators and other representatives of the industry and the National Agricultural Chemicals Assn. explained to various officials the difficult problem of achieving complete stability of methyl parathion in a dust formulation, and gave assurance that a study would be made to solve the problem. The article brings the reader up to date from that point.

ous formulations involving organic phosphates. Results have been varied and leave much to be desired.

Experimental dust formulations were prepared in concentrate form on an attapulgite-type carrier and stored in a constant temperature oven at 50° C. (122° F.) for extended periods of time. Samples were prepared in a small ribbon blender and then hammermilled, using a laboratory-size Raymond mill. The sample was split with one-half being stored at room temperature and the other portion stored in the oven.

Analyses were made at regular intervals. The method of analysis was by ultraviolet spectrophotometry. Dust samples were extracted with methyl alcohol, filtered, diluted to a standard volume with additional alcohol and then the ultraviolet absorption determined utilizing a Beckman DU spectrophotometer.

A typical degradation curve was drawn for the unstabilized methyl parathion concentrate. This dust was prepared using an attapulgite-type carrier and stored at 50° C. (122° F.). Degradation was quite rapid initially but tended to decrease with time. Thirty days under these severe conditions is believed to equal four to six months of normal warehouse storage.

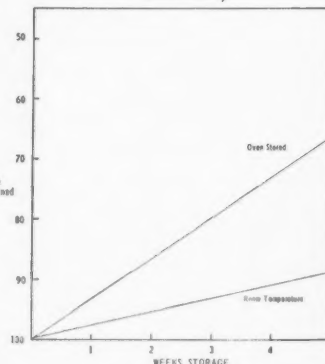
The degradation rate of stabilized material when applied to an attapulgite carrier reduced losses to amounts falling within the limits of analytical methods. Maximum losses will seldom exceed 10% in ten to twelve weeks of storage at 50° C. (122° F.). Stabilized formulations exhibit the greatest degree of stabilization during the first five weeks of storage. Losses of less than 5% are believed to be equivalent to little or no loss under normal storage conditions for periods up to six months.

Figure 1 shows the degradation of an unstabilized field strength dust on an attapulgite carrier stored at 50° C. (122° F.). Within a matter of days loss was rapid and extensive. The figure also shows the degradation rate of stabilized field strength dust.

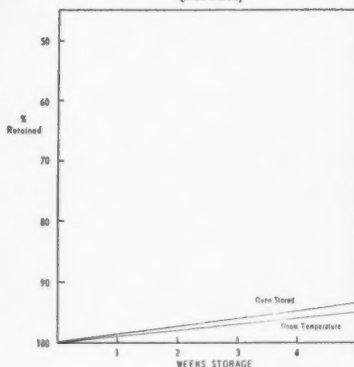
Field strength dusts prepared from

stabilized attapulgite-based concentrates, using kaolin or pyrophyllite diluents as extenders, give an extremely stable dust when stored at 50° C. (122° F.). Losses have been

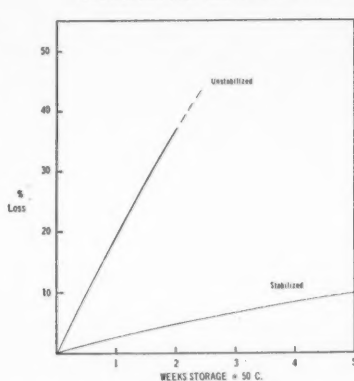
BIOLOGICAL ACTIVITY
METHYL PARATHION DUST CONCENTRATE
(Unstabilized)



BIOLOGICAL ACTIVITY
METHYL PARATHION DUST CONCENTRATE
(Stabilized)



METHYL PARATHION FIELD STRENGTH DUST



of the order of 10% or less for periods up to five weeks. The loss may increase through longer periods of storage or by the choice of poor diluents.

Although stabilized methyl parathion dusts have been definitely shown to retain their activity over much longer periods in storage than unstabilized dusts, there is no increase in the residual life once the dust has been applied to plant foliage in the greenhouse or field.

Standard bioassay techniques utilizing mosquito larvae have shown the complete absence of insecticidal activity on the part of the conditioner being used.

Experimentation has shown that methyl parathion dissolved in acetone and then dispersed in water at a concentration of 1 ppm will kill 50% of a two-day-old population of mosquito

Turn to PARATHION page 27

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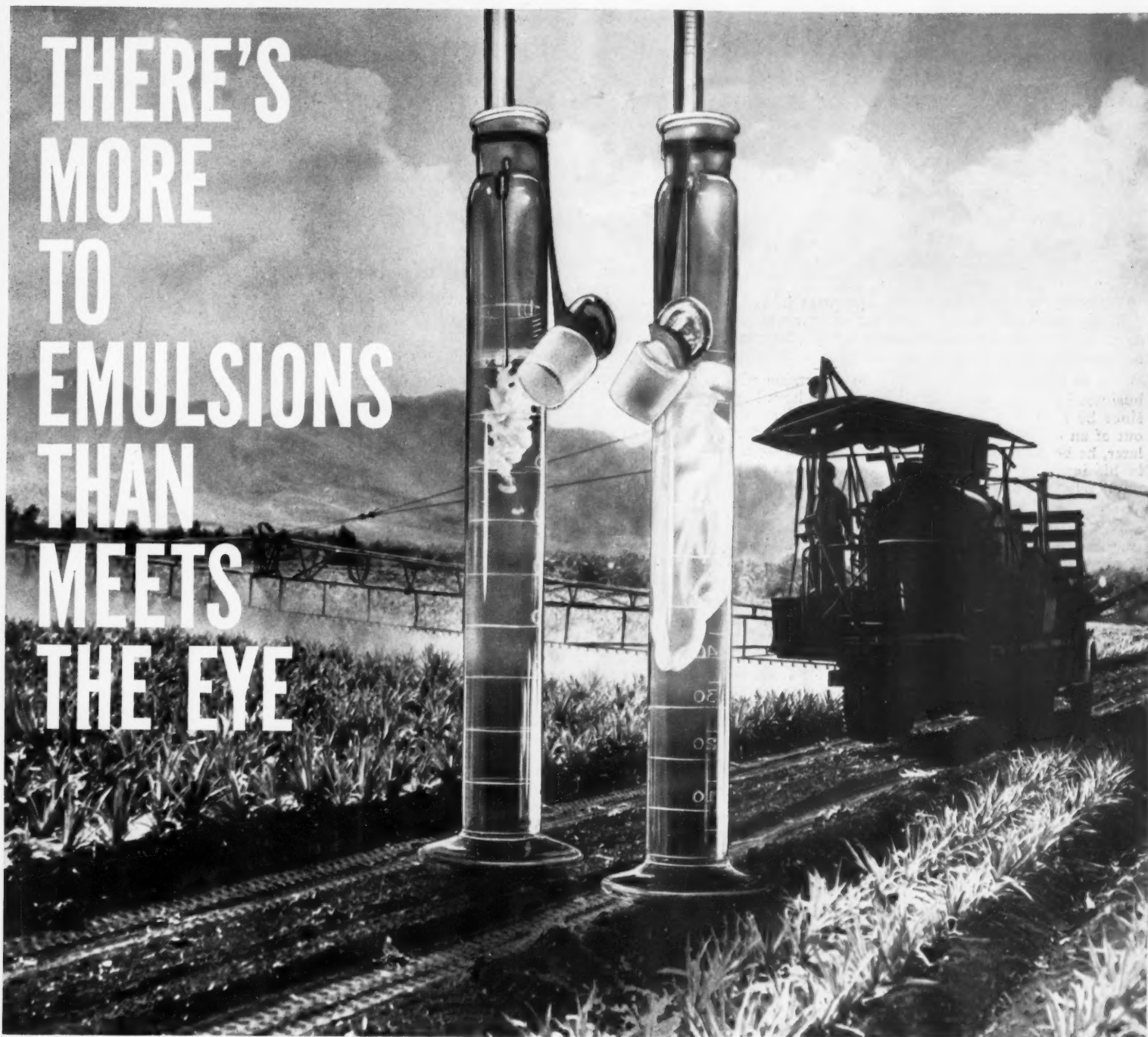
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SUCCESS STORY . . .

Adequate Production Facilities Lauded by Kentucky Manufacturer

"Land-O'Nan" Enterprise based on quality product, confidence of customer, energetic effort to keep on expanding business.

A GROWING FERTILIZER enterprise in Kentucky is operated by its owner, Ed O'Nan. This enterprising young man owns a dry mixing plant and warehouse at Sturgis, Ky. and a liquid plant at Morganfield, some 15 miles northward.

It is difficult for Mr. O'Nan to determine which branch of his business has the most potential, since both have been growing rapidly since he started in business. Actually, the fertilizer enterprise grew out of an original seed business which he opened in 1950. Four years later, he began mixing dry fertilizers and selling them to the farmers in his immediate area. The liquid operation at Morganfield is relatively new but, according to Mr. O'Nan, holds tremendous promise.

The O'Nan organization takes considerable stock in soil testing operations which he encourages his farmer-customers to make. The company operates its own laboratory, but also cooperates with the county soil testing laboratory if the farmer would rather have his tests made there. Mr. O'Nan reports the farmers have great confidence in the soil tests and that from 3,000 to 4,000 tests are made each year in his county.

Like many fertilizer manufacturers, Mr. O'Nan does a considerable business in custom spreading. He has two dry spreader trucks which have proved quite popular. Last year, he serviced some 4,000 acres of land and has established a telephone service which his customers like to use.

In order to get better acquainted with the people in the community, the "Land-O'Nan" Company has an annual fertilizer meeting in which farmers are invited in for dinner. This year's session attracted some 190 customers and this helps to solidify their relations, Mr. O'Nan declares.

He has also established a "bushels ahead club" in which a number of farmers in the community work with him and the vo-ag teacher in the local high school to conduct a complete fertilization program and keep track of the results. Such fertilization programs have been

LIQUID FERTILIZER PLANT—Land-O'Nan liquid fertilizer facilities at Morganfield, Ky. are modern and efficient. Exterior shots at right show building housing mixing units, and one of two liquid spreaders with which company does custom work. Below, Mr. O'Nan, left, and his plant manager, Gordon Martin. Mr. O'Nan resides at Sturgis, site of his dry plant, but is a several-times a day visitor at the Morganfield office.



conducted on corn, and with beef cattle.

Last year he had 48 farmers in the program and he expects more to join it as time goes on. Pastures and wheat are the next crops he expects to concentrate on with a fertilization program.

Despite the fact that many acres of land in Union County, where he operates, have been taken out for roads and industrial sites as well as many hundreds of acres for Camp Breckenridge, his soils and fertilizer tonnage increases every year.

"The customers are all the same," he said, "but they have increased their production each year. Our pasture fertilization this year will open the eyes of many of these farmers in our area. We expect to fence off certain pasture areas and keep accurate count of the weight gains of both cattle and hogs in order to show the value of fertilization," he said.

"The main thing is to get the farmers started on such a program and usually they keep right on going. We have to sell on the basis of service, not price," he indicated.

The liquid plant operated by Mr. O'Nan is modern and efficient. Two spreader trucks serve the farmers in Union County who desire liquid fertilizer applied on their acres. Of about 800 farms in the county, 600 are actually producing. The other 200 cannot be counted as potential customers for fertilizer, but the nucleus of 600 are providing plenty of challenge to the fertilizer enterprise.

The use of modern mixing and pumping equipment in his liquid plant is the answer to many problems, he believes. In fact, he is planning on building a new warehouse for dry storage in which potash will be stored. It is likely that he will be selling the potash separately as well as including it in complete liquid mixes as has been done in the past.

In addition, Mr. O'Nan is contemplating the addition of a 12,000 gallon nitrogen tank to augment the existing storage facilities at the plant.

Manager of the Morganfield operation is Gordon Martin. Gene Odom is superintendent of the plant.

In order to produce high grade fertilizer products, the operator must have first class machinery and equipment to do it. Mr. O'Nan believes in these principles and illustrates their veracity by actual operation.



DRY MIXING PLANT — Land-O'Nan's dry fertilizer operations are centered in this plant at Sturgis, Ky. The dry fertilizer business was begun in 1954 as an outgrowth of a thriving seed business in this Kentucky community. Two spreader trucks do custom fertilization, and the remainder of the plant's output is bagged.

Bemis Vice President Retires After 45 Years

ST. LOUIS — P. E. Morrill, vice president of Bemis Bro. Bag Co., has retired after 45 years of service with the company. Among other duties, he served as company patent officer and was responsible for operation of the insurance department and the Claremont, N.H., paper mill.

Mr. Morrill will continue as a director of the company. For many years he played an important role in the capital investment policies of the company.

Mr. Morrill joined Bemis in 1914 as a clerk in the Boston office. He was transferred to the engineering department in St. Louis in 1915, and was named head of that department in 1922. He was elected assistant secretary and a company director in 1936, and secretary in 1937.

In 1941, Mr. Morrill was elected

vice president and named director of personnel, St. Louis general offices. He transferred to the Boston office to assume responsibility for various administrative functions in 1947.

Mr. Morrill was born in Haverhill, Mass., and was graduated from the Massachusetts Institute of Technology. He currently resides in Boston.

Bag Plant Manager Named by St. Regis

NEW YORK—St. Regis Paper Co. has announced that Lynn Willoughby has been appointed resident manager of the company's multiwall bag plant at Toledo, Ohio. Mr. Willoughby, who has been assistant manager there, succeeds Arthur G. Hartman, who died recently.

Mr. Willoughby joined St. Regis in 1936 at the Carthage, N.Y., bag plant and became plant manager. In 1951, he was named assistant manager of the Toledo bag plant.

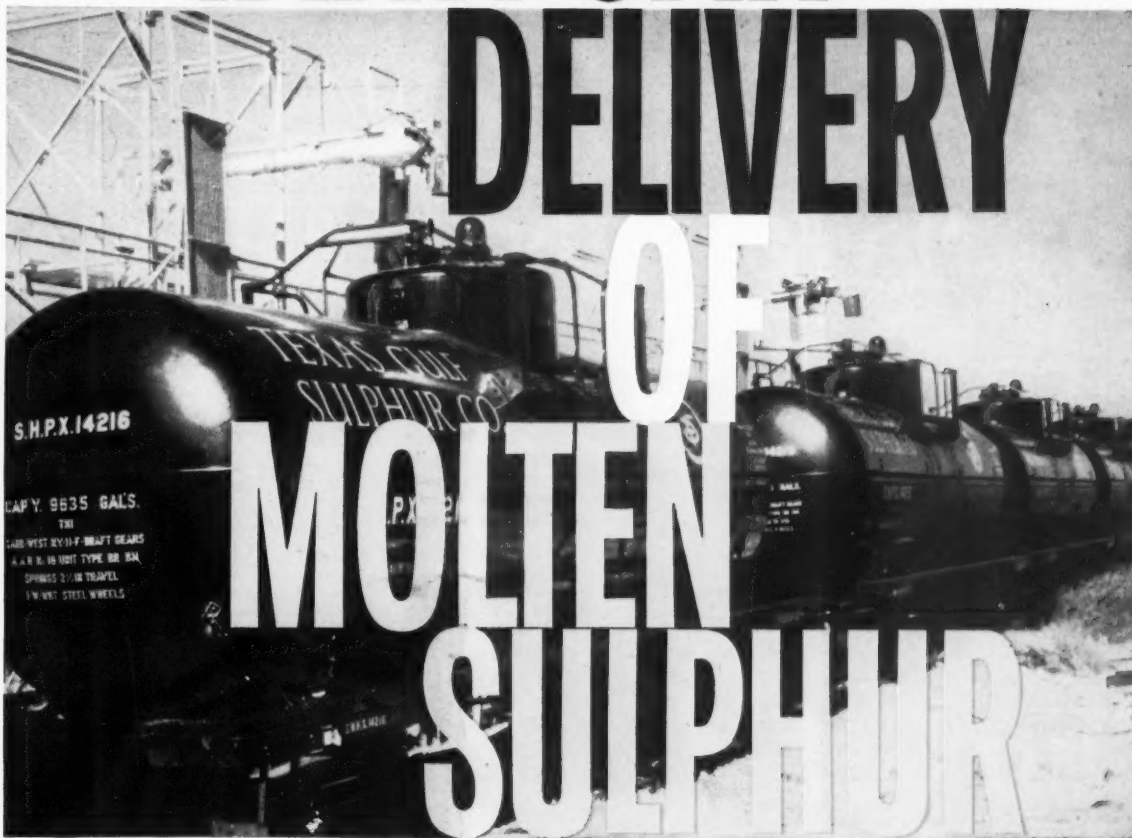
Green Belt to Open New Plant in Ohio

MINSTER, OHIO—The Green Belt Chemical Co., with headquarters in Bryant, Ind., will open a plant in Minster soon, according to the Minster Civic Assn. About four acres adjacent to Canal Road has been acquired and a building with 20,400 square feet of floor space will be constructed.

ASSISTANT MANAGER NAMED

RICHMOND, CAL.—The appointment of Clarence S. Anderson as assistant manager of the credit division of California Spray-Chemical Corp. was announced by Charles M. Stutfield, manager of the division. Mr. Anderson will work in the Richmond home office and will assist in developing and administering the credit policies of the company.

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Role of Ammoniator and Sparger In Causing Serious Nitrogen Loss

EXTENSIVE PILOT PLANT tests on ammoniation and granulation made by the Tennessee Valley Authority over a period of some 18 years developed an efficient continuous ammoniation method with various sizes of beds, ammoniators, and sparger arrangements.

Despite successful operation under pilot plant conditions, the continuous ammoniators working commercially on a large scale basis in fertilizer manufacturing plants were reported in some cases to have developed undesirable characteristics. It was reported that heavy fuming and high nitrogen losses were being encountered . . . a surprising development since such problems had not come up previously.

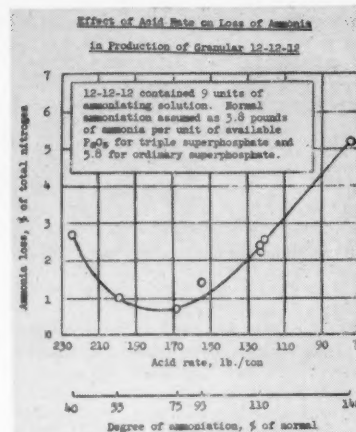
What was the cause? It appeared that either these commercial plants were losing more than the pilot plants had, or else the pilot plants had been losing more nitrogen than they knew.

The probable cause of this new problem is the lack of any suitable criterion for scaling up the pilot-plant data. Most equipment manufacturers assumed that the capacity of an ammoniator was proportional to its volume. We cannot criticize them for this since no

better formula was available to offer.

A 6- by 6-foot ammoniator has eight times the volume of a 3- by 3-foot pilot-plant unit. Since the pilot plant operated satisfactorily at 3 tons an hour, the 6- by 6-foot unit was expected to handle 24 tons an hour.

The reaction, however, occurs not throughout the entire volume of the ammoniator, but in the immediate vicinity of the spargers. The length of the spargers of the 6- by 6-foot unit is only about twice the pilot-plant spargers, although they must deliver eight times as much ammonia and



acid. Therefore, for each foot of sparger length, four times as much chemical reaction occurs. This can cause local overheating, overgranulation, mud formation, and attendant fuming and nitrogen loss.

A typical pilot-plant acid sparger has an active length of 15 inches with twenty holes spaced $\frac{3}{4}$ inch apart. When the pilot plant is operated at 3 tons per hour on a formulation using 140 lb. acid a ton, the amount of acid discharged through each hole is 21 lb., or 1.4 gal. an hour. In large-scale ammoniators the sparger length is increased, but sometimes the spacing of the holes is also increased so that there may be no more holes than in the pilot-plant unit. So we may have as much as 168 lb. or 11 gal. an hour through each hole. This can cause localized spots of high acidity which can cause serious nitrogen loss.

To obtain some idea of the extent of the nitrogen loss problem, all available reports of state laboratory analyses of fertilizer samples were collected and examined. Averages of thousands of samples showed that the nitrogen content of 10-10-10 and 12-12-12 was consistently low. For instance, in a typical state the average analysis of 12-12-12 was 11.5-12.5-12.5. About half of the samples were deficient in nitrogen to an extent that exceeded the tolerance set by state law.

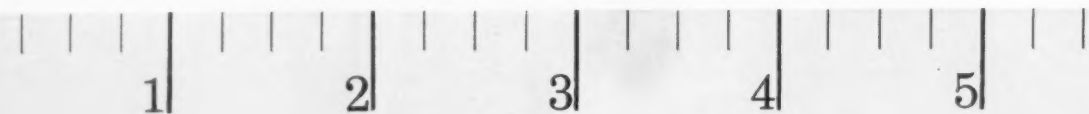
We have been assured by many manufacturers that the nitrogen input is at least equal to that guaranteed, usually appreciably more than guaranteed. If we assume that the average manufacturer formulates 12-12-12 to contain the same amount of nitrogen, P_2O_5 , and K_2O and comes out with 11.5-12.5-12.5, then a full unit of nitrogen must have been lost. If the P_2O_5 and K_2O contents were formulated to be exactly 12%, we must assume that there has been an unanticipated weight loss of about 80 lb. to account for the overage of these elements. It seems evident that the nitrogen loss is not primarily ammonia since ammonia loss would not cause so much weight loss.

The heavy nitrogen loss is an economic loss in several ways: the actual value of the nitrogen lost, the shrinkage in weight of the product, the overage in P_2O_5 and K_2O for which the manufacturer does not get credit, and the penalties and unfavorable publicity due to deficiencies found by state laboratories. These economic losses have been estimated to amount to several million dollars per year.

During much of the previous pilot-plant work on the continuous ammoniation process, primary emphasis

EDITOR'S NOTE

This discussion on nitrogen losses is part of the talks presented at the recent pilot plant demonstrations of Tennessee Valley Authority, Wilson Dam, Ala. T. P. Hignett, chief of the applied research branch and Alvin B. Phillips, chief of the process engineering branch, TVA, presented the comments reproduced here.



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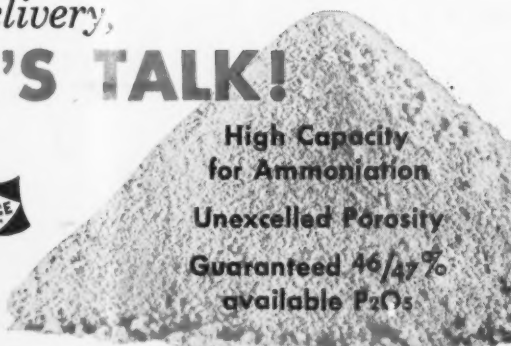


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was placed on the development of workable formulations for most of the popular grades. One of the requirements of a workable formulation was that it should not result in excessive loss of free ammonia. A loss of more than 5% of the free ammonia in the formulation, as determined by analysis of the ammoniator exhaust gas, was considered excessive. Occasionally, tests were made in which the ammoniator exhaust gases were analyzed for other nitrogen compounds such as ammonium chloride and soluble oxides of nitrogen.

These tests did not disclose important losses other than the loss of free ammonia. Nitrogen losses determined by material balance occasionally failed to correlate well with the ammonia loss; however, these discrepancies were generally attributed to factors such as segregation, difficulty in sampling, and the short duration of the runs which tended to make the balances less accurate than the gas analysis.

With the increasing number of reports of failure in commercial units to make grade with respect to nitrogen, it became obvious that losses of nitrogen not detected in the pilot-plant work were involved. Consequently, a series of special tests was made to obtain further information on the loss of nitrogen.

The 12-12-12 grade was chosen for this work because, of the more popular grades, it is the one in which highest nitrogen losses are reported. The formulation used was the standard one used in the majority of plants. It contained 9 units of nitrogen from solution and 3 units from ammonium sulfate. Other materials were ordinary and triple superphosphate, potassium chloride, and sulfuric acid. Following is a discussion of some of the data obtained in the tests.

In pilot-plant production of 12-12-12 grade at a 2-ton-per-hour rate, the amount of sulfuric acid used in the formulation was varied from 75 to 225 lb. a ton of product to study the effect of the acid rate on loss of nitrogen as determined by ammoniator exit gas analysis for ammonia. Ammoniating solution and sulfuric acid were fed through the 30- and 15-inch distributors, respectively. In varying the acid feed rate, the degree of ammoniation of the superphosphates in the formulation was varied from about 40 to 140% of the normal value (3.8 and 5.8 lb. ammonia/unit of available P_2O_5 for triple and ordinary superphosphate, respectively).

Data showing the effect of acid rate on loss of nitrogen as ammonia in the ammoniator are plotted in the chart. The degree of ammoniation also is shown for the various acid rates. It shows that the lowest loss (0.7%) was obtained at about 75% of the normal degree of ammoniation (170 lb. sulfuric acid/ton). The loss increased at about equal rates as the degree of ammoniation increased or decreased from the 75% value. At a degree of ammoniation of 40% the loss was 2.7%. At a degree of ammoniation of 110% the loss was 2.4%, and at 140% of normal ammoniation the loss increased to 5.2%.

It is believed that at the low degrees of ammoniation the high acid rates caused the increasing losses by raising the temperature of the material and by promoting overagglomeration. Nitrogen losses other than ammonia undoubtedly occurred in these tests, but their measurement was not sufficiently reliable to permit correlation with the acid rate.

It is not wished to infer that these pilot-plant results can be applied directly to large-scale plants. The conditions for minimum nitrogen loss undoubtedly will vary depending on plant equipment, method of operation, and formulations used. However, in large units it is likely that ammonia loss will be increased by increased acid rates at some level of acid addition.

Fertilizer Technology on ACS Meeting Agenda

NEW YORK—Recent advances in fertilizer technology and soil testing will be discussed by the American Chemical Society's Division of Fertilizer and Soil Chemistry during the society's 136th national meeting which opens in Atlantic City, N.J., Sept. 13.

Thirty-three technical reports by authorities in the fertilizer field have been scheduled, beginning Monday afternoon, Sept. 14, and continuing through Thursday morning. There will be a symposium on soil testing on Tuesday, Sept. 15. All sessions of the division will be held in the Haddon Hall Hotel.

A highlight of the division program will be a luncheon address on Tuesday by Dr. Bruce D. Cloaninger, secretary-treasurer of the Association of American Fertilizer Control Officials. His topic will be "The Consistency of Change."

M. D. Sanders of Swift & Co. is

chairman of the Division of Fertilizer and Soil Chemistry. T. P. Hignett of the Tennessee Valley Authority is vice chairman and J. O. Hardesty of the U.S. Department of Agriculture is secretary. The group is one of 21 ACS divisions which will sponsor scientific and technical reports at the meeting.

The week-long ACS meeting will bring together some 12,500 chemists and chemical engineers from all parts of the U.S. and several foreign countries.

Chemical Exposition Set For New York in November

NEW YORK—New development in continuous process analysis and control will be an important feature of the 27th exposition of chemical industries, to be held at the New York Coliseum, Nov. 30 to Dec. 4. Rapid evolution in this field since the last exposition, two years ago, has

brought many innovations, exposition officials point out. New techniques for research and new equipment for production will be shown.

Exhibits of new instruments and control will form one display and equipment for reducing, formulating and treating all manner of materials will be shown in many exhibits.

Olin Mathieson Sales, Earnings Up This Year

NEW YORK—Olin Mathieson Chemical Corp. has reported second quarter earnings this year were more than 100% greater than in the corresponding 1958 period. Net profits of the corporation for the first six months of 1959 were 79% higher than in the first six months of 1958.

Domestic and Canadian sales of the corporation in the second quarter of 1959 totaled \$187,387,000, a 27% increase over sales of \$148,006,000 in the like 1958 period.

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Ammonium Nitrate Solutions In Fertilizer Manufacturing Continue Fast Growth Pattern

By C. E. Franklin
Phillips Petroleum Co.
Spokane, Wash.

FEW industries have shown the rapid growth which the synthesis of ammonia and other fixed nitrogen compounds have experienced. A large percentage of our 4 million tons per year ammonia production is being upgraded into other forms of liquid or solid nitrogen fertilizers.

One of the largest tonnage nitrogen materials produced from ammonia is nitrogen solutions. Solutions of ammonium nitrate, ammonia, and water are the principal sources of nitrogen in mixed fertilizers. Most ammonia plants that have facilities for the manufacture of these nitrogen solutions are supplying the mixed fertilizer industry with solutions. In recent years, these and other types of nitrogen solutions have been promoted for direct application to the soil.

Nitrogen solutions were first introduced as a nitrogen fertilizer material in the early 1930's. These solutions of nitrogen compounds were used for both a direct application material and by fertilizer manufacturers in the ammoniation of superphosphates. However, the use of nitrogen solutions as a direct application material made relatively little headway until after World War II.

Growth since then has been rapid as shown in consumption figures. In the fertilizer year of 1947, less than 3,000 tons of nitrogen solutions were applied as a direct application material. The tonnage increased to 245,000 tons for the fertilizer year of 1957. Of this, 45,000 tons were reported to have been used in the Pacific Coast states, Washington, Oregon, and California.

Nitrogen solutions are solutions of nitrogen salts in water with or without anhydrous ammonia. The soluble salts may be ammonium nitrate, urea, ammonium sulfate, or sodium nitrate. However, by popular usage, the term "nitrogen solutions" is taken to classify these solutions as being one containing ammonium nitrate. Solutions containing urea are recognized as "urea solutions" or by their trade names.

Nitrogen solutions used for direct application may be divided into two types: The non-pressure solutions, and the low-pressure solutions. Solutions whose total nitrogen is from the soluble nitrogen salts and contain no free ammonia have no vapor pressure. The low pressure solutions contain both the soluble nitrogen salts and ammonia. Their low vapor pressure is due to the free ammonia present, and as a result, must be handled with pressure equipment.

This group of non-pressure solutions is available with nitrogen contents ranging from 16 to 21%. A particular note should be made of the crystallization or salting-out temperature of these solutions. This is the temperature which causes some of the dissolved nitrogen salts to crystallize and settle out. When this occurs, the crystals may settle and form a troublesome sludge which clogs transfer lines and/or applicator nozzles. Also when nitrogen salts settle out in a storage tank, the composition of the remaining liquid is changed to one of a lower unstandardized nitrogen concentration.

The temperatures at which these ammonium nitrate solutions crystallize is dependent upon the concentration of the nitrogen salt. The

more concentrated these solutions, the higher the crystallization temperature. The 16% nitrogen solutions containing 45.7 weight per cent ammonium nitrate has a crystallization temperature of only 11° F., while 21% nitrogen solutions containing 60% ammonium nitrate have a high crystallization temperature of 51° F. This fast increasing crystallization temperature with ammonium nitrate concentration is the limiting factor on the nitrogen content of this liquid fertilizer.

The reason for these several different ammonium nitrate solutions with different concentrations is to be able to give the consumer a solution with the highest practical nitrogen content which will have a crystallization temperature above the minimum working temperature in his geographical area during the season of the year in which the solutions are to be used.

The composition and physical properties of low-pressure nitrogen solutions are given in Table II.

The two principal differences between these low-pressure nitrogen solutions and the non-pressure ammonium nitrate solutions are the higher nitrogen content—37% to 41%—and the vapor pressure. Each of which is due to the presence of free ammonia in the low-pressure solutions. Different solutions of this type are also offered to give a wide range of crystallization temperature. The crystallization temperatures of these solutions are dependent not only upon the ammonium nitrate content, but also on the free ammonia content as ammonia in solution will lower the crystallization temperature. The higher the ammonia content in a solution, the lower the crystallization temperature. This increased ammonia content which lowers the crystallization temperature will, however, increase the vapor pressure of the solution.

Solutions with a high vapor pressure should not be used in warm weather as the vapor pressure may cause the pumps to vapor lock. Therefore, the solution with a high vapor pressure and low crystallization temperature is designed for use during winter months. The low vapor pressure solutions are for use during summer months.

The weight of nitrogen solutions is 8.9 to 9.8 lb. a gallon which is nearly twice that of ammonia. While the nitrogen content is not more than one-half of anhydrous ammonia on a weight basis, on a volume basis, it is approximately the same, i.e., a 100-gallon tank of nitrogen solutions will hold approximately the same number of pounds of nitrogen as a 100-gallon tank of anhydrous ammonia.

One of the major characteristics of nitrogen solutions which should always be taken into consideration when handling these solutions are their corrosion characteristics. Carbon steel and cast iron are corroded by these solutions. The metals which ammonia attacks—copper, brass, bronze, and galvanized metals—are also subject to rapid corrosion by nitrogen solutions. Material recommended for the storage, handling, and application of nitrogen solutions are aluminum and its alloys, rubber, neoprene, polyethylene and vinyl resins.

Non-pressure nitrogen solutions containing no free ammonia can be applied by surface application, i.e.,

TABLE I—COMPOSITION AND PROPERTIES OF AMMONIUM NITRATE SOLUTIONS

Composition			Properties		
% Nitrogen	% Ammonium Nitrate	% Water	Wt. of solution per gallon at 60° F.	Wt. of nitrogen per gallon at 60° F.	Crystallization Temp. ° F.
16.0	45.7	54.3	10.05	1.61	11
17.5	50.0	50.0	10.22	1.79	22
19.0	54.3	45.7	10.46	1.99	34
20.0	57.3	42.7	10.53	2.11	42
21.0	60.0	40.0	10.73	2.25	51

TABLE II—COMPOSITION AND PROPERTIES OF LOW PRESSURE NITROGEN SOLUTIONS

COMPOSITION			PHYSICAL PROPERTIES		
Total nitrogen	Wt. %		Vapor pressure at 104° F. PSIG		
Ammonium nitrate	Wt. %		Crystallization temp. ° F.		
Anhydrous ammonia	Wt. %		Specific gravity at 60° F.		
Water	Wt. %		Pounds per gallon at 60° F.		
			Pounds N per gallon at 60° F.		
41.0	41.0	37.0	11.0	16.0	1.0
65.7	55.9	44.8	+21	-25	+48
21.9	26.1	16.6	1.14	1.07	1.18
12.4	18.0	16.6	9.50	8.91	9.03
			3.90	3.65	3.64

this fertilizer can be applied on the surface of the soil and does not have to be injected under the soil to prevent nitrogen losses. The ability to be applied by surface application contributes to the main advantages of these non-pressure solutions; high speed of application, and low power requirements for applying these solutions.

The non-pressure fertilizers can be applied in all of the common ways of fertilizer application, i.e., addition to irrigation water, surface and subsurface soil placement and aerial application. However, the largest percentage of these non-pressure solutions are applied with boom spray applicators.

The liquid flow systems for the boom-type surface applicators may be divided into three general classifications: (1) Gravity, (2) pump, and (3) compressed air. The gravity systems are low in initial cost and are generally simpler to operate. The rate of application is determined by the size and number of outlet orifices and the speed at which the applicator travels. The gravity systems are most adaptable to flat terrain and narrow swaths or short booms. Various methods are used to help compensate

for the fluctuation in rate of flow due to the variation in height of liquid level in the applicator tanks.

Pump equipment used is of many types. The pumps may be metering piston pumps, metering hose pumps, diaphragm, or gear pumps. The pump may be ground-driven, power take-off, or auxiliary engine driven. Care should be given in the selection of pumps to see that all parts which may come in contact with the solutions are non-corrosive.

One very important use of nitrogen solutions in the fertilizer industry, of course, is their use as ammoniating solutions in the manufacture of mixed fertilizers. Nitrogen solutions containing free ammonia are mixed with superphosphate, both normal and concentrated, potash, and phosphoric or sulfuric acid as required.

The free ammonia from the nitrogen solutions reacts with or combines with the superphosphates and acids present. These reactions form stable nitrogen compounds in the fertilizer mixes in the form of ammonium phosphates and ammonium sulfate. The ammonium nitrate in the solution serves as supplemental nitrogen to further increase the nitrogen content of the mixed fertilizers.

Nine Transfers, Promotions Announced by Agrico

NEW YORK—The following changes in production personnel have been announced by D. S. Parham, vice president in charge of production for the American Agricultural Chemical Co.:

W. C. Coale, Jr., former foreman at East St. Louis, becomes assistant superintendent at East St. Louis.

W. M. Callahan, former assistant superintendent at Cleveland, Ohio, has been named superintendent at Three Rivers (Phoenix), New York.

L. V. Gue, former assistant superintendent at Carteret, N.J., becomes superintendent at Cincinnati, Ohio.

J. T. Hailey, former assistant superintendent at Baltimore, Md., has been transferred to Detroit in the same capacity.

Elbarae Harrison, former general foreman at Pierce, Fla., becomes superintendent at Johnson City, Tenn.

P. J. Iten, former foreman at Knoxville, Tenn., was named assistant superintendent at Danville, Ill.

M. E. Johnson, former foreman at Detroit, becomes assistant superintendent at Carteret, N.J.

G. M. Lloyd, Jr., former assistant superintendent at Detroit, Mich., becomes responsible for sodium tripolyphosphate production at Carteret, N.J., reporting to H. C. McKinnon, plant superintendent.

K. R. Treiber has been transferred from Three Rivers, N.Y., to Fulton, Ill., as assistant superintendent.

Mississippi Plant's Production Increases

NEW ALBANY, MISS.—Production at the Mississippi Federated Cooperative fertilizer plant is now sched-

uled at 25,000 tons annually, according to Tommy Mask, manager.

Most widely used mixtures are 6-8-8, 9-12-12 and 5-10-5, all of which are manufactured in pelleted form.

The plant is owned by the Mississippi Federated Cooperative, and the fertilizer is shipped to over 50 stores, and sold to both members and non-members.

Mr. Mask says there is a trend toward more pasture and hay fertilization. "Soil testing, farm meetings and publicity concerning the effectiveness of fertilizers have helped in getting more farmers to use fertilizers."

Nopco Appoints Formulator For Insecticide Laboratory

NEWARK, N.J.—Nopco Chemical Co. announced the appointment of Gobind Makhijani to its industrial technical service laboratory as a formulator in the insecticide laboratory. According to Jack Levy, director of the service laboratory, Mr. Makhijani will be responsible for the development of new emulsifiers for insecticides, herbicides, fungicides, and defoliants.

Born in what is now Pakistan, Mr. Makhijani received his early education there and took his B.S. degree in agriculture at the University of Bombay. A recipient of a Fulbright-Smith-Mundt Scholarship for graduate work, he received an M.S. degree in chemistry and toxicology of insecticides from Cornell University in 1952. Returning to India, he was employed as a plant manager by the Shell Chemical Co.

Mr. Makhijani, who established permanent residence in the U.S. three years ago, was associated with the Foster D. Snell and Geigy Chemical companies before joining Nopco.

What's New?

Additional information is available about new products, new services, and literature described in this department. Circle the numbers of items on which you desire more information, fill in your name, your job title, your company's name and address on the card. Then clip it out of the page and mail. No postage is necessary.

No. 9103—Air Vibrator

A new four-page bulletin detailing applications of its one-piece air vibrator has just been announced by the National Air Vibrator Co. These are used for moving bulk materials through hoppers, bins and chutes in a variety of industrial plants including chemicals and fertilizer.

Navco models are said to operate successfully in hazardous atmospheres, extreme moisture conditions, outside in severe weather, and in magnetic dust conditions. Specifications and mounting information on eight different Navco models are included. Copies of the brochure may be obtained by checking No. 9103 on coupon.

No. 9109—Tractor Shovel

A four-wheel-drive, rubber-tired tractor shovel with 5,000 lb. carry-



ing capacity has been announced by the Frank G. Hough Co. Features

of the unit, designated Model H-50, include more power available for both hydraulics and traction, more efficient torque-converter, complete power-shift transmission, power-transfer differentials, power-steering, pry-out bucket action, safety boom arms, power-boosted brakes and numerous refinements, company literature claims. The gasoline and diesel engines provide from 90 to 92 h.p. The unit has a large capacity oil-bath air cleaner, a cartridge-type oil filter that is built into the hydraulic reservoir and similar filters for engine, transmission and torque-converter oil. The torque-converter is a single-stage, two-phase converter with a torque-multiplication factor of 2.57 to 1 at stall. For complete details, check No. 7597 on the coupon and mail.

No. 9108—Neoprene Gloves

Neoprene-coated industrial gloves so flexible that a workman can pick up a pin while wearing them, have been developed by Hood Rubber Products, a division of the B. F. Goodrich Co. The company says the flexibility and comfort of the new gloves are greater than that of any other oil-resistant industrial glove because its knitted jersey shell (glove-like liner) is coated with neoprene to resist many chemicals, acids, oils and greases.

The company says the new gloves

reduce hand fatigue since they require less effort to bend the fingers. They also provide additional safety features. This flexibility is also said to reduce clumsiness usually expected by wearers of coated industrial gloves, the company reported. The gloves are made in three sizes. For further information on the gloves, check No. 9108 on the coupon.

No. 9110—Conversion Chart

A reference table for engineers and other executives in wall chart form has been published by Precision Equipment Co. Included are common conversions such as inches to centimeters or watts to H.P. as well as many conversions that are difficult to



locate in reference manuals. (Some such examples are atmospheres to Kgs./sq. cm., cm./sec. to miles/hr., cu. ft. to liters, microns to meters, quintal to lb., etc., etc.)

For a free wall chart of conversion factors, check No. 9110 on coupon.

No. 9104—Shipping Bags

New stepped-end multiwall shipping bags, made especially for fertilizers, chemicals and insecticides have been announced by Ames-Harris-Neville Co. The stepped-end is formed by staggering the various paper plies, then folding and gluing them to produce pliable, squared ends. Similar, somewhat smaller bags have been used for several years in the cement industry and have greatly reduced breakage.

Because the ends are squared, the user gets extra identification space at each end of these new bags so the



user's brand may always be seen.

The makers say the new bags are built with an especially large valve to speed spout filling. The valve tucks in after filling to prevent sifting or leakage, and the bags are easy to handle, lie flatter, thus are easier to stack, it is claimed. Anti-skid surfaces are available without upcharge. For further information, check No. 9104 on the coupon and mail.

No. 9106—Drum Plug

Rieke Metal Products Corp. has developed an explosion-proof drum plug designed to act as a relief valve when internal pressures of from 13 to 15 psi are developed within the drum. The valve allows volatile gases to be vented harmlessly. The makers state that the purpose of the plug, which fits drums utilized for shipping and storing of various solvents and chemicals, permits the escape of expanded gases as they are generated, thereby preventing rupture of the drum and the spreading of its contents, the makers state. Further information is available by checking No. 9106 on the coupon and mailing.

No. 9111—Pesticide Sticker

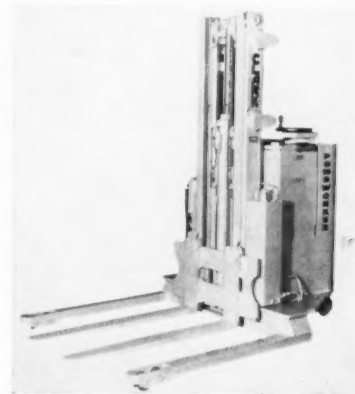
A descriptive bulletin on its new pesticide sticker has been issued by Halloway Corp. The patented material is described as a solution of two or more water-insoluble resins in methanol. It is said to mix readily with water, forming a colloidal dispersion having a milky appearance. The makers say that the new material, though made from sugar, contains no sugar nor is it a sugar by-product. The sticker solution, it says, is clear and dark in color. When it dries on a surface, it remains tacky and is not washed off with water. When stirred into water, the resins precipitate out as a fine colloidal suspension. The material causes pesticides to adhere to the surface of plants and after the water has dried off, the toxicant is not readily removed by weather or rain.

The makers state that the sticker "greatly increases the retention properties of ordinary insecticide water spray mixtures." The bulletin presents data on tests made with the product on apples, peaches, tomatoes, corn, potatoes, cucumbers and on dairy cattle. Copies of the bulletin are available by checking No. 9111 on the coupon.

No. 9116—Straddle Truck

Information on its battery powered, rider-type straddle truck for tiering palletized materials in confined areas has been issued by Clark Equipment Co. Named the "Powrworker Rider Straddle Stacker," the machine is available in 2,000 and 3,000 lb. capacities, both at 24-inch load center.

The unit will carry capacity loads



through aisles as narrow as 42 inches. Its turning radius is 62 inches, and it has travel speeds up to 4.6 mph. without load and 4.2 mph. with load, both forward and reverse. The minimum aisle needed for right angle stacking is 71 inches, the makers state. Check No. 9116 on coupon, and mail to this publication.

No. 9115—Fertilizer Conditioner

The ability of its diatomaceous silica product, "Celite" to coat a granule or prill of fertilizer is described in a recently released brochure, Johns-Manville says that diatomite is an ideal conditioning agent for fertilizers. It is described as being a light, fluffy, inert powder composed of finely divided particles with high surface area. The product is absorbent and has affinity for both granular and prilled fertilizers. It is mined from the world's purest commercially available diatomite deposit and produced by advanced scientific methods, the makers state. Described as particularly important characteristics are its different particle structure, loose weight density (less than 10 lb. per cu. ft.) and its high liquid absorption (200%). For full information on the product, check No. 9115 on the coupon.

Send me information on the items marked:

- ☐ No. 9103—Air Vibrator
☐ No. 9104—Shipping Bags
☐ No. 9106—Drum Plug
☐ No. 9108—Neoprene Gloves
☐ No. 9109—Tractor Shovel

- ☐ No. 9110—Conversion Chart
☐ No. 9111—Pesticide Sticker
☐ No. 9115—Fertilizer Conditioner
☐ No. 9116—Straddle Truck

NAME

POSITION ☐ Fertilizer Mfr.

COMPANY ☐ Pesticide Mfr.

ADDRESS ☐ Both

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THE MAN WITH THE MULTIWALL PLAN



**UNION
PACKAGING SPECIALIST
HENRY SCOTT**

**simplifies
packer's
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"How can we get more out of our Multiwall dollars?"

The question, put by a Southern packer to Union Packaging Specialist Henry Scott, led to a complete analysis of the company's bagging operation. The analysis in turn produced three important recommendations. And \$42,000 annual savings!

Working through Union's 5-Star Packaging Efficiency Plan, Scott reduced the size of one bag. The shorter Multiwall gives firmer packing and neater stacking. Further package

engineering enabled the company to reduce its range of Multiwall bag styles and sizes by 30 per cent!

Union's Art Department also created a family of high-recognition designs for the firm's existing products. And finally, a brand new design which will help launch 400,000 tons of new product to be marketed this year.

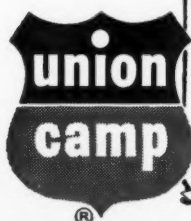
Perhaps Union's 5-Star Plan can help unearth a money-saving idea for you. Perhaps several. Worth looking into, wouldn't you say?

**Union Multiwall Recommendations
are based on this 5-Star
Packaging Efficiency Plan**



- DESIGN
- EQUIPMENT
- CONSTRUCTION
- SPECIFICATION CONTROL
- PLANT SURVEY

**Better Multiwall performance
through better
planning**



UNION'S PACKAGE ENGINEERING DEPARTMENT will study your Multiwall bagging methods and equipment and make appropriate recommendations, regardless of the brand of Multiwalls you are now using.

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CONVENIENT LOCATIONS, TOO . . .

Safety Schools Offer Advanced Instruction For Fertilizer Trade

THE FIVE SAFETY SCHOOLS being sponsored by the National Plant Food Institute and the Fertilizer Section of the National Safety Council offer industry production people an unequalled opportunity to learn more about the value of safety programs in their plants, and from a practical standpoint, how to conduct them.

On this page is additional information on the five schools as outlined by the NPFI and NSC. Registration, they say, should be made in advance, accompanied by a check or money order made out to the National Plant Food Institute (except in the case of the Ithaca meeting, Aug. 12-13, where checks will go to the New York State School of Industrial and Labor Relations) and mailed to the industry representative in charge of the particular school.

Registration fees are \$20 per person for each school. This fee covers two luncheons and all the instructional material to be distributed at each school.

ADVANCE RESERVATIONS

ROOM RESERVATIONS—for the schools at Ithaca, Atlanta, Fresno and Pasadena, should be made directly with the hotel or motel concerned, with all requests marked "Safety Conference." Reservations for the Chicago meeting may be made through the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., or directly with any hotel there.

KEY PERSONNEL INVITED

WHO'S INVITED—All fertilizer manufacturers doing business in a particular region are invited to send production managers, safety supervisors, plant superintendents, foremen and anyone else connected with responsibility for safe operating conditions in their plants.

REDUCE ACCIDENTS

PURPOSE OF SCHOOLS—According to John E. Smith, Spencer Chemical Co., Pittsburg, Kansas, the objective is "to make training in accident prevention available to supervisors of every fertilizer plant in the U.S." He adds: "In turn, these key men will transmit safety training to the workers on their production lines. We hope in this way to achieve drastic reductions in the lost-time, injury-frequency rate of the fertilizer industry throughout the nation."

TABLE 1

The fertilizer industry ranks near the bottom of the list of chemical industries in injury-frequency rates per million man-hours. Table indicates relative ratings in this category:

	First Quarter	
	1959	1958
Explosives	1.7	2.6
Synthetic fibers	1.7	2.0
Synthetic rubber	2.3	2.8
Industrial organics	4.0	5.1
Gases	6.1	9.1
Soaps	6.6	6.4
Drugs and medicines	6.9	7.6
Paints and pigments	9.2	10.2
Miscellaneous chemicals	14.9	14.3
FERTILIZER	15.0	12.4
Oils and fats	27.7	28.6

NEEDED: SAFETY PROGRAMS—The above table is eloquent in showing need for further educational programs to reverse the accident trend in the industry. Note that the industry's injury-frequency rate jumped from 12.4 in early 1958 to 15.0 during the same period of 1959.

School Bells Ring Again . . .

Here is the partial list of topics to be covered at various sessions of the five safety schools:

"The Foreman's Safety Job for All Line Management and Supervisory Personnel."

"Preventing Accidents—Not a Separate Activity, but an Integral Part of the Job."

"Safety Attitudes."

"The Principal Unsafe Acts Leading to Accidents."

"What Management and Foremen Can Do to Control and Influence Human Behavior."

"Meaning of Accident Prevention to the Insured."

"The Scope of Safety Work."

"Safety Education and Training Fundamentals."

"The Handling of Liquid Materials in the Fertilizer Mixing Program."

"Know Your Accident Problems, Elements, Sources and Effective Measures for Preventing Accidents."

"Safety Organization—The Leadership and Responsibility for Establishing an Effective Safety Program."

"The Supervisor as Leader and Teacher."

"Review of Fertilizer Industry Accidents in California, 1958-59."

Subjects will be discussed by experts, with opportunity for further questions and answers.

WHO - WHAT - WHEN - WHERE

Here are brief outlines of the schools; their dates, locations, and names of leaders in charge:

★ ★ ★

Ithaca, New York

Statler Inn, Cornell University, Aug. 12-13

Stratton McCargo, GLF Soil-Building Service, Ithaca, will be the industry representative at the two-day school. Participating in the instruction portion of the program will be W. C. Creel, North Carolina Department of Labor, Raleigh, and Harlan Perrins, Cornell University.

★ ★ ★

Chicago, Ill.

National Safety Council Headquarters, 425 N. Michigan Ave., Aug. 18-19

John E. Smith, Spencer Chemical Co., Pittsburg, Kansas, will be industry representative. Because the school will be held at NSC headquarters, John Nahikian of the National Safety Council will participate on the program of instruction.

★ ★ ★

Atlanta, Ga.

Heart-of-Atlanta Motel, Aug. 27-28

Quentin S. Lee, Cotton Producers' Assn., Atlanta, will be the industry representative, while Prof. W. N. Cox, School of Industrial Engineering, Georgia Institute of Technology, will take part in the school instruction.

★ ★ ★

Fresno, Cal.

Hacienda Motel, Nov. 5-6

At this meeting, Orm J. Chinnock, Hercules Powder Co., Hercules, Cal., will be the industry representative and W. C. Creel and John E. Smith participants in the school instruction.

★ ★ ★

Pasadena, Texas

Tropicana Motor Hotel, Nov. 12-13

Industry representative of this Texas meeting will be A. I. Raney, Phillips Petroleum Co., Bartlesville, Okla. W. C. Creel and George L. Pelton, the latter of The Smith Agricultural Chemical Co., Columbus, Ohio, and chairman of the fertilizer section, will handle the school instruction.

Arcadian® News

Volume 4

For Manufacturers of Mixed Fertilizers

Number 7

CASH IN ON THE TREND TO N Put More N in N-P-K

Since the 1945-46 fertilizer year, consumption of the three major plant foods has risen rapidly. Use of nitrogen has gone up fastest of all; however, this spectacular growth was mostly in straight nitrogen materials. Nitrogen marketed in mixed goods showed only a gradual increase, as compared to big increases

for P_2O_5 and K_2O in mixed goods. Far more nitrogen is sold as straight materials than in mixed fertilizers.

Yet it is practical, efficient and economical to supply most of the nitrogen needs of most crops with mixed fertilizers. This situation represents a tremendous opportunity for fertilizer manufacturers

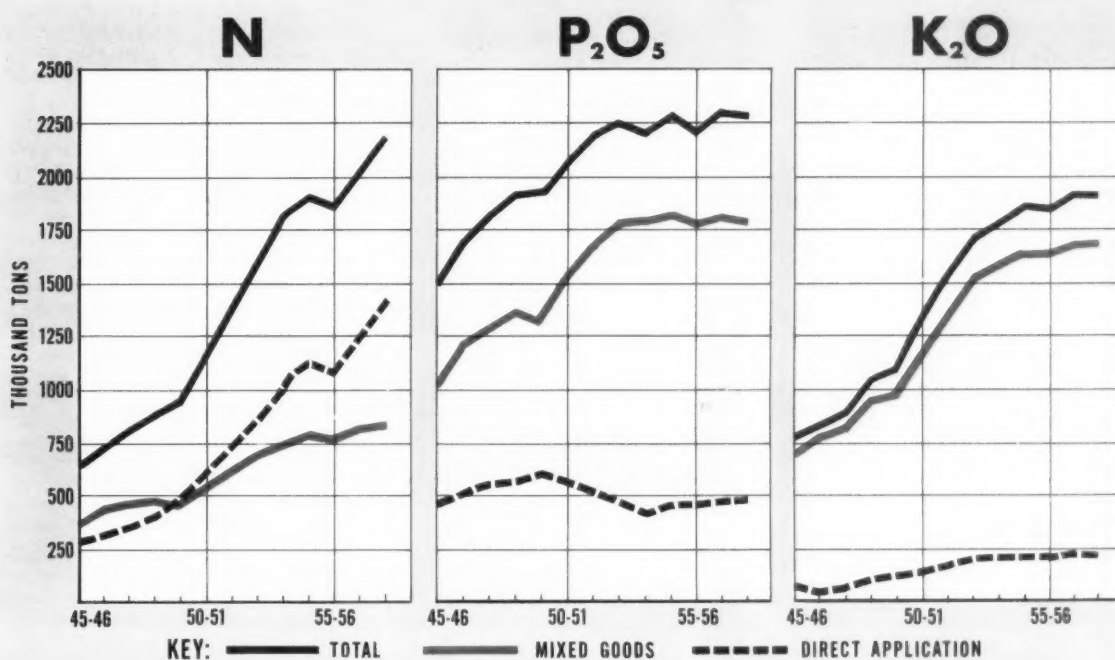
to cash in on the trend to N, by putting more nitrogen in mixed fertilizers.

Even with the big increase in nitrogen consumption, few farmers now use enough nitrogen to get best returns from the other plant foods in their soil.

Farmer acceptance of high-analysis,

(Continued on following page)

U. S. CONSUMPTION OF MAJOR PLANT FOODS



(Continued from preceding page)

high-nitrogen mixed fertilizers has been excellent in all areas where marketed. More and more fertilizer manufacturers are climbing on the high-nitrogen band wagon. 2-1-1 and 3-2-2 grades are agronomically sound for many crops and are moving up in popularity.

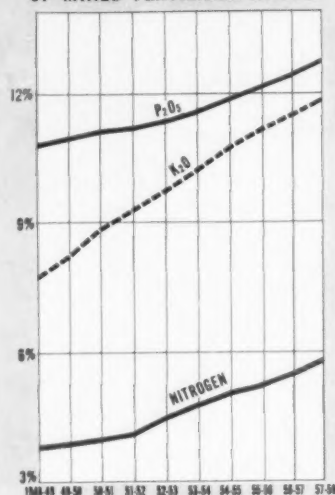
Big Consumers of Nitrogen

Most of the leading fertilizer-consuming crops need more nitrogen than any other plant food. Corn, wheat and cotton require more than twice as much nitrogen as phosphoric acid, and far more nitrogen than potash. Modern grazing and hay crops are big users of nitrogen. Animal products produced on farm-grown feeds remove from the soil much larger amounts of nitrogen than of phosphoric acid or potash.

PLANT FOOD REMOVED BY CATTLE AND HOGS PER TON OF PRODUCT SOLD

	N lbs.	P ₂ O ₅ lbs.	K ₂ O lbs.
Cattle	55	32	4
Hogs	91	43	4
Milk	12	4	3

AVERAGE PLANT FOOD CONTENT OF MIXED FERTILIZER IN U.S.



The practice of growing legumes to provide nitrogen is fast declining because the high cost of land makes it uneconomical in most areas. Livestock manure, another traditional source of nitrogen, is not available in quantity, and the cost of loading, hauling and spreading manure is extremely high per unit of plant food. Livestock and dairy farms are a growing market for high-nitrogen fertilizers.

It will pay you to start now to get more of the nitrogen market and more of the total fertilizer market by putting more nitrogen in mixed fertilizers. You get more of the farmer's fertilizer dollar when you supply his nitrogen needs with mixed fertilizer than when you sell him low-nitrogen mixtures that must be supplemented with extra applications of nitrogen.

New Techniques

Today you are in a better position than ever before to make and sell high-nitrogen fertilizers at a profit. You have the market and the methods. The development of new ammoniation techniques enables you to greatly increase the nitrogen content of mixed fertilizers, with all the nitrogen derived from low-cost ARCADIAN® Nitrogen Solutions.

When you balance your fertilizer with adequate nitrogen to meet crop requirements, you also help to insure the best possible return from the phosphorus and potash in your fertilizer. Research has proved that sufficient available nitrogen increases a plant's efficient use of phosphorus and potash.

Bigger Dollar Volume

By producing high-analysis, high-nitrogen mixed fertilizers, you can put a bigger dollar volume of tonnage through your plant. You can also save money in storage and shipping costs per unit of plant food. These costs are becoming more important, with increasing freight rates and the necessity to warehouse more tonnage in late seasons.

With high-nitrogen fertilizers, you increase the farmer's profit, your profit and your dealer's profit. Your dealer can make better use of his storage and trucking facilities. He has less storage cost per dollar of inventory and he hauls a higher value pay load. Most important of all, he can supply his farmer customer with his complete plant food requirements in a one-sale, one-package deal. This builds exclusive customers and minimizes the danger of losing business to a competitor.

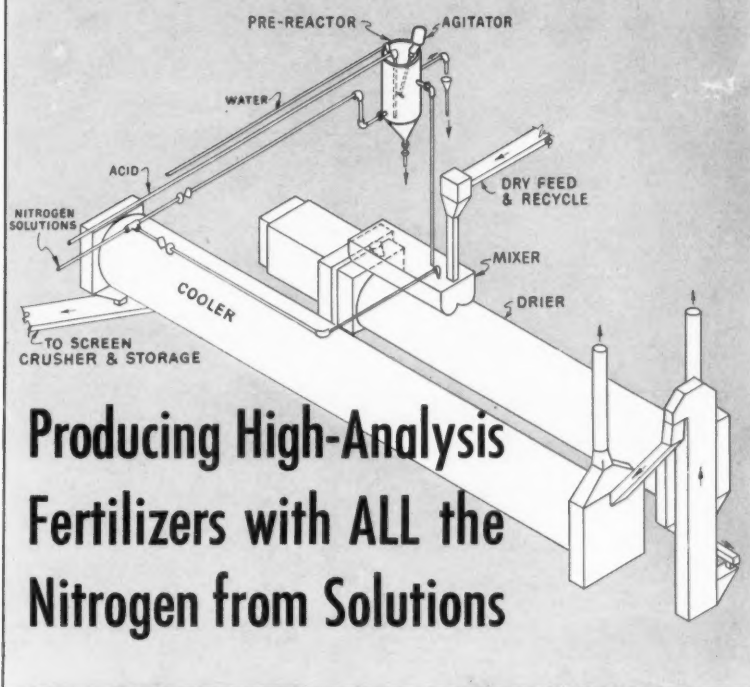
Call Nitrogen Division

It will pay you to start now to make and sell more high-nitrogen mixed fertilizers. Get all the facts on the new and different production techniques that enable you to produce high-nitrogen mixed fertilizers with all the nitrogen derived from low-cost ARCADIAN Nitrogen Solutions. Contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

PLANT FOOD CONTENT OF CROPS

Crop	Yield	Part of Crop	N lbs.	P ₂ O ₅ lbs.	K ₂ O lbs.	Total
COTTON	750 lbs.	lint				
	1,250 lbs.	seed	60	30	20	110
	2,000 lbs.	burrs, leaves and stalks	45	15	45	105
	Total		105	45	65	215
CORN	100 bu.	grain	90	35	25	150
	3 tons	stover	70	25	95	190
	Total		160	60	120	340
WHEAT	40 bu.	grain	50	25	15	90
	1.5 tons	straw	20	5	35	60
	Total		70	30	50	150
OATS	80 bu.	grain	50	20	15	85
	2.0 tons	straw	25	15	80	120
	Total		75	35	95	205

Typical high-analysis fertilizer operation with pre-reactor.



NEW PRE-REACTOR PUTS MORE N IN N-P-K

Now it's easier than ever before for you to supply the growing demand for high-analysis, high-nitrogen mixed goods *at a profit!* By utilizing the new pre-reactor process, you can produce such grades as 16-8-8, 16-4-8, 15-10-10, 12-12-12, and 14-0-14, with *all* the nitrogen derived at low cost from ARCADIAN® Nitrogen Solutions.

Before the development of the pre-reactor, getting maximum use out of nitrogen solutions was limited by the amount of acid that could be added to the mix without developing excessive heat in the liquid phase. Conventional ammoniator-mixers are limited in their capacity to handle this operation with safety and precision.

Keeps Acid Out of Mix

The pre-reactor method keeps all acid out of the mix and confines it to the pre-reactor along with the nitrogen solution. Here, the acid neutralizes the free ammonia in the nitrogen solution. The heat generated by this reaction is dissipated through evaporation of water by the pre-reactor. This avoids the old problem of excessive heat in the liquid phase.

In fact, the pre-reactor provides better control of the heat and water content of

the mix. By adding water to the pre-reactor at an easily determined rate, a constant temperature is maintained and a slurry of uniform nitrogen and water content is fed to the mixer. It's easy to efficiently neutralize all the ammonia in excess of that needed to ammoniate superphosphate.

How the Pre-reactor Works

Specified amounts of acid and nitrogen solutions flow continuously into the pre-reactor through separate distributors. The liquid mass undergoes violent churning by agitator propellers. Water is added to cool the mass and keep it in a liquid state. It is this liquid condition that prevents much of the uncertainty, risk and loss encountered with conventional ammoniator-mixers where the mass of ingredients is relatively dry.

When the reaction is completed in the pre-reactor, the effluent flows by gravity into the mixer to combine with dry and re-cycle materials. This effluent can be delivered into the normal granulating system at a temperature, physical condition and moisture content that favors granulation and holds re-cycle to a minimum. By properly using a pre-reactor in tandem with an ammoniator-mixer

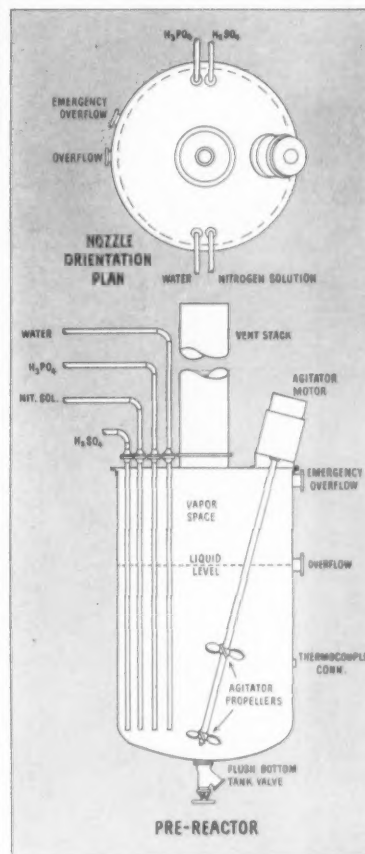
equipped with a double-shafted pug mill, quality granular fertilizers are produced with a recovery of 97 to 98% of nitrogen input.

Get Full Details

If you are interested in producing high-analysis fertilizers in 2-1-1, 3-2-2, 1-1-1 and 1-0-1 ratios, with all the nitrogen from solutions, it will pay you to investigate the new pre-reactor technique. You'll find that you get big benefits in safety, precision and control. And you increase your profits by obtaining *all* your nitrogen from low-cost ARCADIAN Nitrogen Solutions.

There is nothing complicated about incorporating a pre-reactor in a normal high-analysis manufacturing operation. The same standard equipment is used . . . nothing is eliminated. You'll *like* your results in volume, quality and extra profits!

For complete details on how to add a pre-reactor to your present set-up, contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y. Telephone HAnover 2-7300.



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NITROGEN SOLUTIONS

	CHEMICAL COMPOSITION %					PHYSICAL PROPERTIES			
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	-7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

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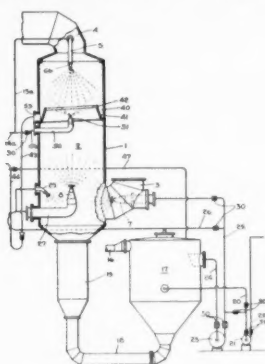
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PRODUCTION PROCESS PATENTS

2,895,800

Method of and Apparatus for Producing Ammonium Sulphate Crystals. Patent issued July 21, 1959, to Carl Otto, Manhasset, N.Y. In producing ammonium sulfate by the liquor and crystal dispersion method in which gas having a small ammonia content is passed through a scrubbing space from a lower gas inlet to an upper gas outlet, the improvement which comprises the steps of spraying a relatively small portion of acidulated



ammonium sulfate liquor having a relatively high sulfuric acid content into the upper portion of said space, spraying a relatively large portion of acidulated ammonium sulfate liquor having a relatively low sulfuric acid content upward into the lower portion of said space, and collecting liquor sprayed into said upper portion of said scrubbing space in an annular space adjacent to the lower end of said upper portion, and withdrawing said collected liquor from said annular space.

2,895,998

Pyrolysis of Benzene Hexachloride. Patent issued July 21, 1959 to John A. Crowder and Everett E. Gilbert, Morris County, N.J., assignors to Allied Chemical Corp., New York. A process for the pyrolysis of benzene hexachloride which comprises contacting benzene hexachloride with a catalyst comprising activated carbon containing about 5 to 10% by weight of a metal chloride selected from the group consisting of cupric chloride, ferric chloride, zinc chloride and aluminum chloride at a temperature of about 400° to 500° C.

2,894,821

Control of Nitrogen in Ammonia Synthesis. Patent issued July 14, 1959, to Earl W. Jordan, Dumas, Texas, and Weller R. Pierce, Bartlesville, Okla., assignors to Phillips Petroleum Co. In a process wherein a synthesis gas comprising nitrogen and hydrogen in a predetermined ratio is fed to an ammonia synthesis zone and wherein said synthesis gas is prepared by reforming a methane containing gas with steam, introducing nitrogen and oxygen-containing gas to the reformation product thereby oxidizing a portion of said products and supplying nitrogen, removing the resulting oxidized products, passing the thus prepared gas to said ammonia synthesis zone, removing the resulting ammonia and recycling the unconverted gas, the improvement comprising continuously withdrawing

a controlled volume of gas from the recycling converted gas, continuously metering the methane content of the withdrawn-stream, venting a portion of said recycling unconverted gas re-

sponsive to changes in the metered methane content from a predetermined value so as to maintain the methane content of the recycling gas constant, withdrawing a second stream of gas subsequent to the preparation of the synthesis gas having a known methane content so as to provide a controlled volume thereof, continuously removing the combustible from said stream of gas, continuously metering the flow of the resulting stream of gas in terms of decreased flow from said second controlled volume withdrawn, removing nitrogen from last said resulting stream, metering the flow of gas after nitrogen removal in terms of the difference in flow before and after nitrogen removal, metering the ratio of the two differences and adjusting said oxygen-containing gas input responsive to changes in the ratio of said differences to maintain a constant nitrogen to hydrogen ratio in said synthesis gas.

2,892,870

Process for Purifying and Crystallizing Urea. Patent issued June 30, 1959 to Pascal Matile, Visp, Switzerland, assignor to Lonza Electric and Chemical Works, Ltd., Basel, Switzerland. In a process for purifying an aqueous urea solution containing turbidity producing suspended impurities of higher and lower relative specific gravity and crystallizing the purified solution: the improvement which comprises mixing said impure aqueous urea solution with a substantially pure urea solution; gravitationally separating said suspended impurities from said mixed solution, said mixed solution being maintained in a crystal-free state during said separation; partially crystallizing said purified mixed solution thereby forming a slurry of mother liquor and urea crystals; separating said crystals from said mother liquor and passing said mother liquor without further crystallization to said impure aqueous

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March 27, 1959

Mr. Shelby W. Brown, Jr.
Bemis Bro. Bag Company
P. O. Box 52
Lakeland, Fla.

Dear Mr. Brown:

Our cost of bags is reduced. We are saving \$7.10 per thousand with Bemis Extensibles. This is a 5% reduction in our bag costs. This amounts to an actual net saving to us of \$355.00 per 50 M car.

The 110 AL 1/80 Bemis Extensible Bags we are using are easier to sew than the 1/90 AL 2/40 1/50 MWK we formerly used. Consequently, our sewing machine operators make fewer errors and our sewing machines are under less strain.

F. E. C. Fertilizer Company

John M. Fredrick

John M. Fredrick, Asst. Gen. Mgr.

HECTOR

agricultural supplies

March 24, 1959

Bemis Bro. Bag Company
P. O. Box 52
Lakeland, Florida

Attention: Mr. Shelby Brown

Dear Shelby:

Just thirteen months ago we received the first trial order of Hector's Fertilizer Bags made with the new extensible paper. Since that time, we have used this type exclusively.

Our savings in cost have been about \$7.00 per thousand. We have had much less breakage than we previously had with bags made from conventional kraft paper. In addition, our employees at the plant say that extensible bags are much easier handled at the scales and much easier to sew.

Hector Supply Company

L. E. Reger

C. E. Reger, Vice-President

GLADES

CHEMICAL COMPANY

AGRICULTURAL CHEMICALS

March 23, 1959

Bemis Bro. Bag Company
P. O. Box 52
Lakeland, Florida

Attention: Mr. Shelby W. Brown, Jr.

Dear Shelby:

Due to the very rough treatment we give bags in our operation, we have always had a problem with breakage. In January, 1958, we started experimenting with both conventional kraft and extensible paper bags of various constructions. We continued this testing until fall and have been using extensible paper bags ever since.

We have eliminated much of our breakage and our customers report they are much better satisfied with these bags. Our present Bemis extensible paper bag is superior to any others we have used to date.

Glades Chemical Company

W. S. Plumer

W. S. Plumer, President

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urea solution for admixture therewith as said substantially pure urea solution.

2,895,870

Grain Fumigant Composition and Method for Making and Using Same. Patent issued July 21, 1959, to Joseph R. Baldrige, Mentor, Ohio, assignor to Diamond Alkali Co., Cleveland, Ohio. A fumigant composition comprising 82-83% by volume carbon tetrachloride, 16.5-17.5% by volume carbon disulfide and 0.51% by volume petroleum ether.

2,894,819

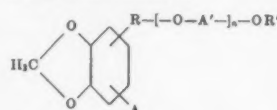
Method for Decomposing Sulfuric Acid Sludge. Patent issued July 14, 1959, to Arthur E. Catanach, Groves, Texas, assignor to Gulf Oil Corp., Pittsburgh, Pa. Method for recovering acid values from sulfuric acid sludge which comprises coating hot coked material while the same is moving in a generally helical path

with sulfuric acid sludge, passing said coated hot coked material along a generally helical path to a decomposition zone in less than about one minute, maintaining the temperature in said decomposition zone sufficiently high to substantially coke the major portion of the hydrocarbon material in said sludge and obtain gaseous decomposition products, removing said gaseous decomposition products from said decomposition zone, removing coked material from said decomposition zone, and recycling a portion of said latter coked material to constitute the hot coked material coated with the sulfuric acid sludge.

2,894,870

Method of Preparing Oil-Free Synergized Pyrethrin Composition. Patent issued July 14, 1959, to Herman Wachs, Baltimore, Md., assignor to Food Machinery & Chemical Corp., New York. A method of preparing an insecticidal composition comprising

pyrethrins dissolved in a synergist therefor, comprising: extracting pyrethrins from pyrethrum with a volatile solvent; adding to the extract so obtained a synergist which is a non-volatile solvent for pyrethrins and has the generic formula:



in which R is a saturated, bivalent, aliphatic hydrocarbon radical, A is a substituent selected from the group consisting of a hydrogen atom and alkyl radicals, R' is a substituent selected from the group consisting of alkyl, cycloalkyl, aralkyl, aryl and heterocyclic radicals, A' is a saturated, bivalent, aliphatic, hydrocarbon radical having from two to three carbon atoms and *n* is an integer from one to three; and subsequently removing the volatile solvent from the solution of pyrethrins in said synergist.

2,894,993

Insecticides and Preparation Thereof. Patent issued July 14, 1959 to Louis Schmerling, Riverside, Ill., assignor, by mesne assignments to Universal Oil Products Co., Des Plaines, Ill. A compound selected from the group consisting of 1,2,3,4,7,7-hexachloro-5-(2-hydroxybenzyl)-bicyclo[2.2.1]-2-heptene, 1,2,3,4,7,7-hexachloro-5-(2-hydroxyphenyl)-bicyclo[2.2.1]-2-heptene, 1,2,3,4,7,7-hexachloro-5-(3-methyl-4-hydroxybenzyl)-bicyclo[2.2.1]-2-heptene, and 1,2,3,4,7,7-hexachloro-5-(3,5-dimethyl-4-hydroxybenzyl)-bicyclo[2.2.1]-2-heptene.

2,893,858

Granulation of Fertilizers. Patent issued July 7, 1959, to Robert A. MacDonald, Highland Park, Ill., and Thomas H. Stewart, Atlanta, Ga., assignors to International Minerals & Chemical Corp. The process of granulating complete fertilizers wherein the entire nitrogenous content added in liquid form is introduced by means of an aqueous nitrogenous solution having at least one substance selected from the group consisting of a mixture of urea and ammonia, and urea alone, which comprises mixing solid fertilizer components comprising predominantly phosphate and potash constituents, thereafter introducing simultaneously but separately, said aqueous nitrogenous solution and an aqueous sulfuric acid solution consisting essentially of sulfuric acid and water into direct contact with the mixing solids, said sulfuric acid being added in sufficient amount to neutralize and react with the unreacted nitrogenous compounds present, maintaining the moisture content of the mixing solids between about 2% and about 15%, whereby the material discharged from the conditioning step remains substantially as wetted particles and crumbly aggregates of particles, and directly thereafter heating the conditioned material while tumbling same in a drying atmosphere, whereby substantially all of the added urea constituent is retained, without substantial hydrolysis, in the final product.

2,894,878

Recovery of Carbon Dioxide Free Ammonia in the Production of Urea. Patent issued July 14, 1959, to Lucien H. Cook, Port Washington, N.Y., assignor to Chemical Construction Corp., New York. In a process for the production of urea the improvement in the recovery of ammonia from the high ammonia synthesis melt consisting essentially of urea, ammonium carbamate, water and ammonia which comprises feeding the molten melt into an intermediate portion of a distillation column, supplying heat to the bottom of the column to drive out substantially all the ammonia from the residue, returning liquid ammonia

to the top of the column, the quantity of reflux being sufficient to remove all the carbon dioxide from the overhead vapor discharge.

2,890,936

Method for Producing Phosphoric Acid. Patent issued June 16, 1959, to Curt S. Benefield, Roselle, N.J. A method of producing phosphoric acid by digestion of ground phosphate rock with aqueous sulfuric acid in a digestion mixture of substantial size, the steps which comprise introducing sulfuric acid into the digestion mixture at a plurality of points, controlling the temperature of said digestion in the presence of cooling coils immersed therein, and having a stream of cooling fluid passing therethrough, continuing the digestion with formation of phosphoric acid and calcium sulfate until a coating of solid calcium sulfate is formed on said coils, then substituting a flow of steam in said coils for the cooling fluid therein while continuing the digestion reaction and thereby removing the calcium sulfate deposit from the coils, then resuming the flow of cooling fluid in said coils while continuing the digestion and recovering the phosphoric acid therefrom.

2,890,937

Method and Apparatus for Production of Aqua Ammonia. Patent issued June 16, 1959, to Dick P. Brees, St. Louis, Mo., assignor to Phillips Petroleum Co. A method for the production of aqua ammonia from ammonia and water which comprises the steps of maintaining a body of water in a first zone having a vapor space above said body, continuously pumping water from said body to a mixing zone; in a first stage, continuously passing a first portion of ammonia to said mixing zone and thereby forming hot aqua ammonia, continuously passing said hot aqua ammonia directly from said mixing zone into said vapor space, passing said hot aqua ammonia as a thin film down a surface defining the periphery of said vapor space and into said body, whereby said body of water thereafter contains absorbed ammonia, passing a film of cool water in indirect heat exchange relationship with said aqua ammonia film and thereby cooling said aqua ammonia film; in a second stage, after all of said first portion of ammonia has been added to said mixing zone and said body of water, continuously passing a second portion of ammonia to said mixing zone and discontinuing flow of said hot aqua ammonia directly to said vapor space and switching said flow of hot aqua ammonia to said body of liquid while simultaneously passing a stream of said body of water containing absorbed ammonia into said vapor space and passing same as a thin film down said surface defining the periphery of said vapor space and into said body, while continuing to pass a film of cool water in indirect heat exchange relationship with said film of water containing absorbed ammonia, thereby cooling the latter; continuing said second stage of operation until all of said second portion of ammonia has been added to said mixing zone and said tank.

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Superphosphate Production For 1959 Exceeds Figures of Last Year, U.S. Report Says

WASHINGTON—Production of superphosphate and other phosphatic fertilizers increased during the month of May, 1959, according to a compilation made by the U.S. Department of Commerce and just issued. Output of these materials amounted to 241,940 short tons (100% A.P.A.) compared with May, 1958, production of 233,338 short tons.

Shipments of superphosphate and other phosphatic fertilizers during the month totaled 181,780 short tons, or a decrease of 1% over the volume shipped during the corresponding month of last year.

Stocks held by producing plants as of May 31, 1959, totaled 163,228 short tons, or 9% less than those held on April 30, 1959, the report said. The Department of Commerce points out, however, that these monthly figures are unadjusted for seasonal variation and number of working days.

From the period of July, 1958, through May, 1959, preliminary totals show that production and shipments of the various grades of superphosphate and other phosphatic fertilizers are nearly all ahead of the previous season.

Totals were listed as follows: Production in the 1959 season was 2,341,084 tons compared to 2,304,190 for last year, or an increase of 2%.

Shipments for 1959 were 1,804,450 tons, compared to 1,701,625 tons last year, making an increase of 6%.

Normal and enriched superphosphate was produced in the amount of 1,281,796 tons in 1959 and the 1958 production was 1,251,479, marking an increase of 2%.

Shipments of normal and enriched superphosphate were also up for 1959, the figures being 700,406 and 678,221 tons, respectively. The increase amounted to 3%.

A little different picture is seen in concentrated superphosphate, however, with production in 1959 being slightly under that of the previous year. Here the figures are 780,623 for 1959 and 806,793 tons for 1958. The loss here is 3%. Shipments of concentrated, however, held up in 1959 enough to surpass those of the previous year by 3%. The tonnage shipped in 1959 and 1958, respectively, was 831,238 and 782,057, respectively.

Other phosphatic fertilizers listed in the U.S. Department of Commerce report made stronger gains in 1959. Output of these materials for the current year was 278,665 tons as compared to 245,648 tons last year, for an increase of 13%.

Similarly, gains were made in shipments of phosphatic fertilizers other

than normal and enriched and concentrated. The totals here were 272,806 tons and 241,374 tons for 1959 and 1958, respectively. This was an increase also of 13%.

The Department of Commerce points out that statistics contained in this report include data for all plants known to have facilities for superphosphate and other phosphatic fertilizer materials manufacture, including government-owned plants. All quantities are expressed in equivalent short tons of 100% A.P.A. (avail phosphoric oxide). The statistics pertain only to superphosphate and phosphatic fertilizer materials as

such, and include no data for these products in dry-base or dry-mixed goods.

Figures for receipts of materials, shipments, consumption, and stocks relate only to plants which actually produce these items.

1959 Round Table To Cover Current In-Plant Problems

WASHINGTON — An interesting instructive program of items that concern current problems in the processing of granulated and conventional fertilizers constitutes the agenda for the 1959 fertilizer industry round table, according to Dr. Vincent Sanchelli, chemical technologist of the National Plant Food Institute, chairman of the round table.

This year's theme is "Practical

Problems in Processing Fertilizers," he says. Featured will be a detailed description of two plant processes from raw materials to shipment. Two well-known experienced operators will each tell about their layouts, process, mistakes to avoid, good features to accentuate and will be prepared to answer pertinent questions. Plenty of time will be provided for question and answer periods.

Problems associated with the manufacture of conventional type fertilizers will have a place on the program this year. Statistical quality control will be discussed by two noted statisticians featuring theoretical descriptive and practical applied phases of the subject. A subject of universal interest at present is pre-neutralization. A symposium on the subject will be presented.

Registration will begin on Nov. 3 between 7 and 9:30 p.m. at The Mayflower Hotel. Those who can are urged to register at this time. Registration will continue at 8:30 a.m. Nov. 4.



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Tests Made on Sequestration With Superphosphoric Acid*

Tests of the production of liquid fertilizers from wet-process phosphoric acid with a sequestering agent added to prevent precipitation of impurities have been made by TVA. Samples of wet-process acid from several sources were tested but only one was studied in detail. Sufficient sequestrant was supplied as superphosphoric acid (76% P_2O_5) or ammoniated superphosphoric acid (11-33-0 solution) to furnish 5 to 50% of the total P_2O_5 in the product.

In carrying out the tests, wet-process acid, superphosphoric acid and aqua ammonia were fed simultaneously to the reaction vessel so as to maintain an approximately neutral solution (pH about 6.6). Water was added to the reactor either before or during the reaction to adjust the grade of the final solution to about

8-24-0. Other grades were made by adding materials such as urea, nitrogen solutions, and potash salts and adjusting the water addition accordingly.

When ammoniated superphosphoric acid (11-33-0 solution) was used as the sequestrant, water required in the formulation was added to the reaction vessel along with the 11-33-0. Wet-process acid and aqua ammonia then were added simultaneously so as to maintain an approximately neutral solution. Other grades were produced in the same manner as described above.

For evaluation of storage properties, portions of the products were stored for 7 days at 28° to 32° F., and other portions were stored for 30 days at room temperature. The tests indicated that to obtain liquid products

that remained clear during storage under these conditions, a minimum of 20% of the P_2O_5 as sequestrant was required. Less sequestrant was required when it was added either before or during ammoniation rather than after ammoniation. As little as 10% of the P_2O_5 in the form of sequestrant was sufficient to maintain clear liquids for 1 or 2 days at room temperature, and 15% maintained clear liquids for 7 days. It was noted that products containing 30% or more of the P_2O_5 as sequestrant were still clear liquids after storage for as long as a year at room temperature; however, the minimum amount of sequestrant required for such long storage was not determined.

Also, a study was made of the production of 1:1:0, 1:2:0, 1:3:0, 1:1:1, 1:2:1, and 1:3:1 ratio liquid fertilizers from sequestered 8-24-0 base solution. The source of supplemental nitrogen was either urea or urea-ammonium nitrate solution. The salting out temperatures of these materials were measured. Portions of the products

were stored for 7 days at 28° to 32° F., and other portions were stored for 30 days at room temperature. Base solutions were 8-24-0 grade containing 20, 30, 40, and 50% of the total P_2O_5 as 11-33-0 ammoniated superphosphoric acid.

There was little advantage in supplying more than 30% of the P_2O_5 as sequestrant in the above tests except for the 1:1:1 ratio. Clear 1:1:1 ratio liquids were obtained only when 40 or 50% of the total P_2O_5 was present as sequestrant. When 20% of the P_2O_5 was present as sequestrant, ratios other than the 1:2:0 either formed suspensions or became gels during storage.

With urea as the source of supplemental nitrogen, the maximum grades that could be stored satisfactorily at 32° F. were 16-16-0, 11-22-0, 9-9-9, 8-16-8, and 7-21-7. These grades were as high as, or higher than, those that can be produced from electric furnace orthophosphoric acid. The salting out temperatures obtained were usually a little lower than those reported for the comparable grade from electric furnace acid, indicating some increase in solubility from the nonortho P_2O_5 added.

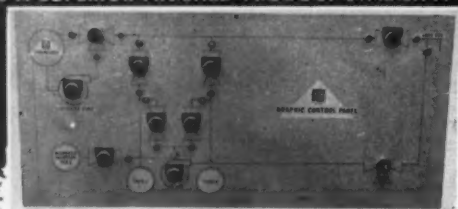
In tests with wet-process acids from other sources, satisfactory solutions were produced when 35% of the P_2O_5 was supplied by superphosphoric acid or ammoniated superphosphoric acid (11-33-0). No other proportions of sequestrant were studied in these tests.

Several companies are now using superphosphoric acid or 11-33-0 solution as a sequestrant with wet-process acid. In one instance, superphosphoric acid has been used for a full season to supply about 40% of the P_2O_5 ; satisfactory operation was obtained.

*Paper presented by J. A. Wilbanks, process engineering branch, TVA, at recent pilot plant demonstrations, Wilson Dam, Ala.

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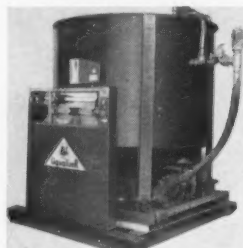
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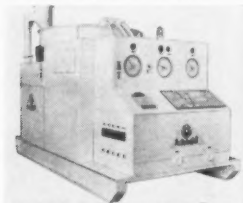
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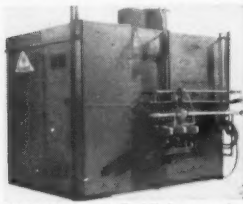
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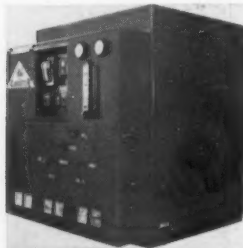
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THE B&L Converter. Automatic or manually controlled liquid nitrogen, "package units" for converting anhydrous ammonia to aqua ammonia.

Hooker Chemical Reveals Plans for Phosphoric Plant

NIAGARA FALLS, N.Y.—Hooker Chemical Corp., Niagara Falls, announced plans for a new replacement phosphoric acid plant which will provide increased tonnage on a more efficient basis and supplement production of this product at Columbia, Tenn., and Dallas, Texas.

Phosphoric acid is used in food, feed and fertilizers.

The new plant should be completed in the late fall, a spokesman said.



Carl J. Rosene

NEW APPOINTMENT—Carl J. Rosene has been named to the position of process engineer at Calspray's new \$4,600,000 fertilizer plant, now under construction at Kennewick, Wash., it was recently announced by Frank J. Juchter, manager of Calspray's manufacturing department. California Spray-Chemical Corp. is the manufacturer of the Ortho line of insecticides, fungicides, fertilizers and weed killers.

NO WEAKLINGS ALLOWED . . .**Ammonia Hoses Must Be Very Tough, Up to Specifications for Safe Handling**

HOW MUCH do people in your plant know about safety standards of anhydrous ammonia equipment? It is emphasizing the obvious to state that everyone having anything to do with the loading, unloading or other handling of NH_3 should be well acquainted with some of the properties of this gas . . . including its hazards.

Practically every state has issued codes having to do with handling of anhydrous ammonia. Minimum safety standards are set for tanks, valves, hoses, etc., and all this should be kept firmly in mind as NH_3 is handled.

An earlier issue of the Production Edition (June 8, page 29) discussed the safety factors of transferring NH_3 from tank to tank with safety, as suggested by the Division of Industrial Safety of the State of California. Here are some further California requirements on hoses, safety valves and other equipment having to do with anhydrous ammonia:

"Hose and hose connections shall be fabricated of materials that are resistant to the action of anhydrous ammonia.

"All hose and hose connections subjected to tank pressure shall be designed for a minimum working pressure of three hundred fifty (350) psi with a factor of safety of at least five (5).

"After the hose connections are made up, they shall withstand without leakage a test pressure of twice the working pressure for which the hose is designed.

"Hose and hose connections located on the low-pressure side of pressure-reducing valves or devices and discharging to atmospheric pressure shall be designed for a working pressure of at least sixty (60) psi with a factor of safety of at least five (5).

"All hose one-half inch ($\frac{1}{2}$ ") in diameter and larger used for either liquid or vapor service shall be permanently and clearly marked at intervals of not more than five feet (5') with the following information:

- (1) The words Anhydrous Ammonia or NH_3
- (2) The designed working pressure
- (3) The manufacturer's name or trademark
- (4) The year of manufacture

"Hose smaller than one-half inch ($\frac{1}{2}$ ") in diameter need only be marked with items (1) and (2) above.

"All anhydrous ammonia hoses and hose connections subjected to tank pressure shall be tested at least once each year to twice the tank working pressure but not less than five hundred (500) psi. While in transit all hoses and hose connections shall be protected from wear or injury.

"All low-pressure hose shall be constructed for ammonia service with a factor of safety of at least five (5), but in no case shall hose be used for this service unless designed for a working pressure of at least sixty (60) psi with a factor of safety of at least five (5).

Safety Relief Valves

"Every vessel used in anhydrous ammonia service shall be fitted with one (1) or more safety relief valves in direct communication with the vapor space. These safety relief valves shall be of the spring-loaded type suitable for anhydrous ammonia service. The discharge from safety relief valves shall be full size and be directed away from the vessel, and shall discharge upward and unobstructed to the open air.

"Except for code paragraphs U-68, U-69 and UW-52 (b) tanks, the discharge capacity of safety relief valves for anhydrous ammonia tanks shall be sufficient to prevent pressure in the tank from exceeding one hundred

twenty percent (120%) of the allowable working pressure of the tank. ASME code paragraphs U-68, U-69 and UW-52 (b) tanks shall have safety valve capacity sufficient to prevent pressure in the tank from exceeding one hundred thirty-five percent (135%) of the allowable working pressure of the tank. All safety relief valves required by this order shall be ASME rated and stamped.

"The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than two thousand five hundred square feet (2,500 sq. ft.), the required flow rate can be calculated

ed using the formula: Flow Rate CFM Air = $22.11 A^{0.82}$, where A = outside surface area of the container in square feet.

"The minimum required rate of discharge of safety relief valves for anhydrous ammonia ICC cylinders shall be in accordance with the regulations of the Bureau of Explosives.

"Safety relief valves shall be so designed and installed that the possibility of tampering will be minimized. If the pressure setting is external, the relief valves shall be provided with acceptable means for sealing the adjustment.

"Shutoff valves shall not be installed between the safety relief valve and tank, except that a shutoff valve may be used where the arrangement of this valve is such as always to provide full required capacity flow through sufficient relief valves to properly protect the tank. [This exception is intended to permit three-

way valves, mechanically interconnected valves, etc., to be installed between the tank and safety valve where the installation and arrangement will always permit the required number of valves to be in communication with the tank to provide the relief capacity required by the regulations.]

"Each safety relief valve used on anhydrous ammonia tanks shall be plainly marked with the following information:

- (1) With the letters 'AA'
- (2) The pressure in pounds per square inch gage (psig) at which the valve is set to start to discharge.
- (3) The rate of discharge of the valve at its full open position in cubic feet per minute (cfm) of air.
- (4) The manufacturer's name and catalog number.
- (5) The symbol of the ASME code."

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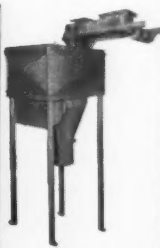
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NEWS DIGEST OF THE WEEK

Explosion in Hooker Plant Kills Worker

NIAGARA FALLS, N.Y.—A severe explosion in a chemical processing building at the Niagara Falls, N.Y.,

plant of Hooker Chemical Corp. on July 22 killed one employee and caused damage set at approximately \$200,000 as a preliminary estimate. The cause of the accident is being studied by a plant investigating committee.

Company spokesmen said warehouse stocks of the chlorinated organic chemicals made by the company are expected to be adequate to supply customers without interruption until the processes can be started up again elsewhere in the plant within approxi-

mately 30 days. Other processes were unaffected except that operations in the adjacent area were shut down temporarily as a safety precaution.

No one was in the building itself at the time of the explosion but two employees fairly near the building were treated for shock while the body of Edward M. Zaczek, 38, an electrician in the maintenance department, assigned to do some repair work in the building, was found about 30 feet from the building, having been hit by flying debris and burned by the fire after the explosion.

Stauffer in Joint Venture With West German Firm

NEW YORK — Stauffer Chemical Co. and Kali-Chemie A.G. are concluding an agreement to form a joint company to produce and market a special insoluble sulphur in Western Europe. The company, to be known as Kali-Chemie-Stauffer G.M.B.H., plans to build a plant at Hannover, Germany, which, it is anticipated will be in production by January, 1960. Output of the new facilities will be marketed, under the Crystex tradename, by Kali-Chemie A.G.

Kali-Chemie A.G., a major manufacturer of chemicals, has 15 plants in Western Germany. It produces a range of heavy chemicals, fertilizers, catalysts and pharmaceuticals. Stauffer, the largest U.S. producer of processed sulphurs, manufactures some 400 industrial and agricultural chemicals and operates 50 plants in the U.S.A. It also has interests in chemical manufacturing enterprises in Canada, Mexico, Australia, Argentina, Germany and Spain.

L. H. Wilson Elected to National Board

GAINESVILLE, FLA. — Louis H. Wilson, secretary and director of information for the National Plant Food Institute, Washington, D. C., was elected to the board of directors of the American Association of Agricultural College Editors, at the group's annual conference held at the University of Florida, July 13-15.

Mr. Wilson became the first associate member representative of the organization to be elected to office in the 43-year history of the group which embraces state extension and experiment station editors in the land-grant colleges.

Ralph Reeder, associate director of agricultural information, Purdue University, Lafayette, Ind., was elected president of the association.

Canadian Fertilizer Plant Purchased

PORT HOPE, ONT.—Purchase of the factory and physical assets of Grand Valley Fertilizers, Ltd., at Orangeville, Ont., has been announced by Agricultural Chemicals, Ltd. In making the announcement, M. J. Daignault, director and general manager of the purchasing firm, said this addition will bring to four, the number of fertilizer plants being operated by his firm in Canada. In addition to the new facility at Orangeville, other plants are located at Port Hope and London, Ont., and Ft. Chambly, Que.

The Orangeville plant is strategically located between the company's plants at London and Port Hope, according to Mr. Daignault.

WEED CONFERENCE

WINNIPEG, MAN.—A joint meeting between the Western Canadian and North Central Weed Control Conferences will be held Dec. 7-10 at the Royal Alexandra Hotel, Winnipeg, it has been announced. Complete reports on herbicide formulations will be presented.

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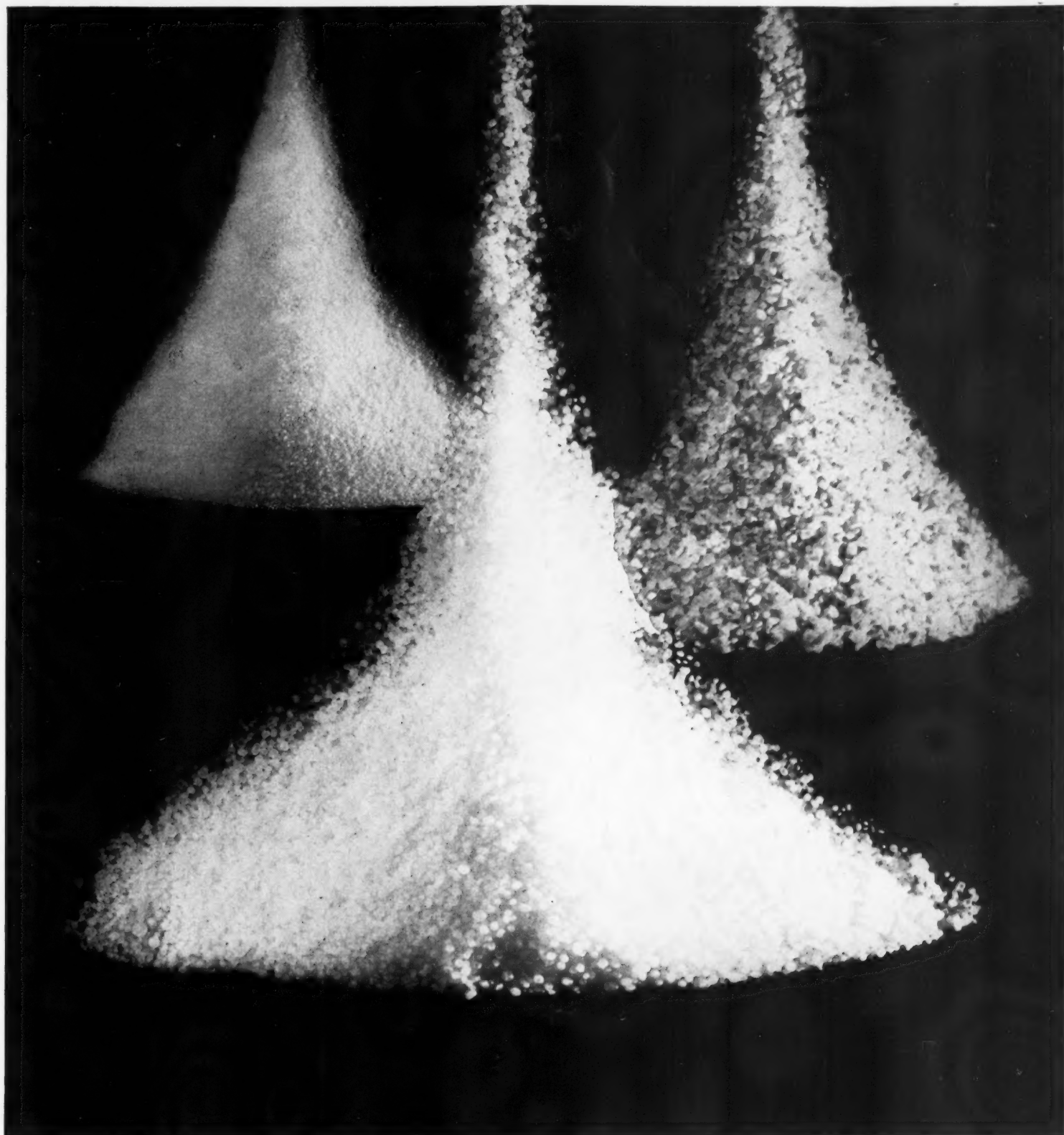
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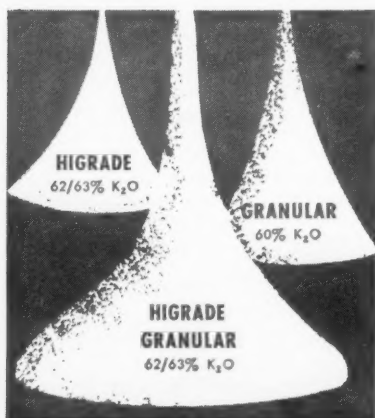
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New Economies Realized by Virginia Plant Management In Revamped Bagging Setup



BAG HUDDLE—Clarence B. Robertson, center, president of Robertson Chemical Corp., looks over plans for revamped packaging setup with Gatewood Brock, left, general purchasing agent, and R. E. Cartledge, sales representative for Union Bag-Camp Paper Corp., cooperators in engineering the new system.

ROBERTSON CHEMICAL CORP., producer of both pulverized and granular fertilizers in five plants in the South, recently underwent a number of changes in its packaging routine which it says amount to sizeable economies over the period of a season.

In its South Norfolk plant, Robertson reduced the size of the bags which made possible savings in the cost of the bags themselves. They report further that bag breakage on the sewing line was reduced through use of bags with broad tape strips for reinforced sewing. Reduction of breakage turned out to be important both in the plant and also in the hands of customers, the company says.

One of the most important economies realized, Robertson says, is in the reduction of variances in the weight and quantity of materials put in bags. Irregularities of as much as one pound in a 100-lb. bag had occurred earlier, it was reported.

New versatility in bagging equipment has been realized through the shift, the Robertson firm says. It can now bag fertilizers in either burlap or paper in sizes ranging from 25 to 200 lb. via the open-mouth method. Both pulverized and pelletized fertilizers may be packaged in the same mill.

The Robertson firm, which observes its fiftieth anniversary this year, has been providing fertilizer needs for customers in its Southern marketing area for a long time. Its decision to modernize its packaging facilities came after a thorough study of the economic factors involved, including the seasonal nature of the fertilizer manufacturing business.

Like all other fertilizer manufacturers, the problem centers around how to operate at maximum efficiency during peak periods as well as during the balance of the year.

Robertson reports that the new system enabled the firm to eliminate one man from the conveyor line. A single bagging machine operator now spouts the bags which drop on a moving conveyor after being charged. The bags then move to a second operator who folds and guides the bags into the sewing guide where they are automatically sewn through the reinforced tape ends. A third man then stacks the bags for loading.

The system, planned and installed by Union Bag-Camp Paper Corp., has been in operation now for a number of months. S. H. Hall, superintendent of Robertson's South Norfolk plant, says that his firm has reduced loss through closer weight tolerances in bagging with the sewn open-mouth equipment. "This can cut 'giveaway' in half and effect substantial savings over a period of one year," he says, pointing out that actual savings will be accurately determined at the end of the first year of operation.

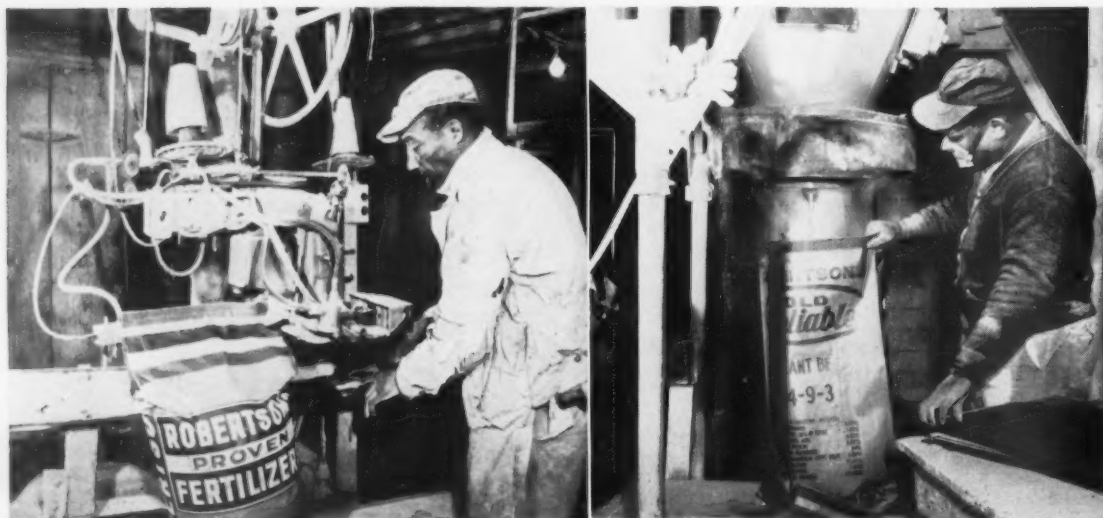
As compared to the former equipment used in the South Norfolk plant, the new open-mouth equipment can package 51 tons an hour, as compared to 39 with the old equipment. "The new baggers not only sustained higher production rates with less expensive bags, but provided the additional advantage of packing both pulverized and pelletized fertilizers," a company spokesman declares.

Under the former system, the Robertson management recalls, it was necessary for operators to change over from one type of packer to another when mixed orders were filled. The cost of shutting down one line and starting up another, plus lost time in adjusting the beam scale was considerable, it is reported.

Presently, changeover time is minimized with no necessity for changing mills. A simple adjustment of one lever plus a scale adjustment makes the changeover complete.

While making the switch to new bagging equipment for more economical operation in the plant, the Robertson firm cooperated with Union Bag-Camp Paper Corp. in the development of new bag designs to identify the three grades of fertilizer produced by the company. Out of these sessions emerged a family design for easier identification of the firm's line: "Blue Banner," premium pulverized, identified by white letters on a blue flag; "Old Reliable," standard brand, identified by distinctive red, white and blue stripes; and "Gold Nugget," pelletized fertilizer, identified by a gold-colored nugget.

Robertson Chemical says it would not have undertaken the investment in the new equipment if it had not foreseen efficiency ad-



BAGGING EQUIPMENT—Robertson Chemical reports significant economies brought about through use of its new packaging equipment. At left is newly-designed Robertson bag moving through sewing machine with "sew-straight" guide and automatic cutter which severs thread in single operation. Bag has moved from Union I & C bagger, seen in picture at right, which fills on open-mouth principle. These photos taken at Robertson's South Norfolk, Va., plant.

vantages which would result in savings. Much thought and a lot of weighing of figures, as well as comparisons with various types of equipment preceded the decision to go ahead. The aim was not only to reduce bag costs but also to speed packaging—thus speeding orders during peak periods.

The Robertson management has expressed satisfaction that the new arrangement has performed the services and economies expected of it, and that the half-century reputation of the firm will be enhanced through the newly-dressed-up packages it now uses for delivery of its various grades of fertilizers.

Liquid Sulfur Terminal Nears Completion

HOUSTON, TEXAS—A new liquid sulfur terminal being installed at Tampa, Fla., by Pan American Sulphur Co. is soon to be in operation, according to reports from the firm.

The company also announces that following completion of the Florida liquid sulfur terminal, construction of a new dry bulk installation will begin. The new facilities will comprise a 50,000-ton capacity dry bulk unit to be operated in connection with the just-completed liquid terminal.

Foreman, Two Salesmen Named by Calspray

RICHMOND, CAL.—Theodore E. Steibing has been appointed production foreman at California Spray-Chemical Corp.'s South Plainfield, N.J., plant, and Don E. Rawlins and Edward W. Mengel have been named Calspray agricultural sales representatives, the company announced.

Mr. Steibing was formerly with Kentile, Inc., where he was a production foreman for six years.

Mr. Rawlins, who will represent Calspray in the middle west, will headquarter out of Maryland Heights, Mo. He was formerly in business for himself as an apple grower.

Mr. Mengel will cover the northeast Atlantic area, with offices in Haddonfield, N.J. He was formerly a navigator in the U.S. Air Force.

Sues Fertilizer Co-op For Accident Injuries

DAYTON, OHIO—A 32-year-old Cincinnati man filed a \$750,000 damage suit for alleged injuries suffered from sulphuric acid as the result of an accident at a Dayton fertilizer plant last January.

Carl Candler brought the common pleas action against the Farm Bureau Cooperative Assn., of Columbus, which operates a fertilizer plant there.

Mr. Candler claims he suffered third degree burns over his head, the interior of his mouth and throat, his chest and other parts of his body when an explosion tore off the top of a truck tank containing sulphuric acid.

Named Superintendent of Georgia Fertilizer Plant

TIFTON, GA.—James Hoyt Whitesides, a native of Tupelo, Miss., has been made superintendent of the Tifton fertilizer plant of International Minerals and Chemical Corp.

Mr. Whitesides came from Clarks-ville, Tenn., where he has been since opening a new plant there for the corporation. He has been associated with International Minerals and Chemical for 30 years.

Olin Mathieson Official Receives 4-H Award

CHICAGO—An Olin Mathieson Chemical Corp. official has received a 4-H award for "outstanding contribution to 4-H Club work in America."

He is S. L. Nevins, vice president of the plant food division at Little Rock, Ark. He was one of four businessmen to receive the crested 4-H clover citation during the National 4-H Conference in Washington, D.C. The presentations were made during a special program honoring all friends of 4-H attended by nearly 500 persons.

Armour Veteran Honored on Retirement

ALBANY, GA.—W. A. Higginbotham, Jr., division manager of Armour Fertilizer Works, was recently host at his camp on Muckalee Creek

near Albany at a retirement party for A. T. Fountain of Hawkinsville.

Mr. Fountain, who has been district manager and sales representative of the Armour company in a seven county area, was presented a gift in recognition of his 28 years of service with the firm.

Mr. Fountain represented Armour in Pulaski, Dooly, Turner, Crisp, Ben Hill and Bleckley counties, as well as a part of Worth County.

APPOINTED SUPERINTENDENT

CONDA, IDAHO—Walter J. DeZell, manager of mining of phosphate property of Anaconda Co. here, has been named superintendent of United Park City Mines Co., Park City district, Utah, according to S. K. Droubay, vice president and general manager of United. He succeeds G. W. DeLaMare who resigned to accept a partnership in Iron King mine near Winnemucca, Nev.

H.R. 6436 PASSES

WASHINGTON—The House of Representatives on July 29, approved the Senate amendment to H.R. 6436, a bill to extend the coverage of the Federal Insecticide, Fungicide and Rodenticide Act of 1947. This means the measure goes directly to President Eisenhower for his signature to make it law.

The bill had passed the Senate on July 16, but because of a technicality involving a minor reference to a code number, the bill had been sent back to the House for correction. The action of the House on July 29 cleared the way for the bill's enactment.

Provisions of the bill amend the 1947 act to include nematocides, defoliants, desiccants and plant regulators which were not in use at the time the original act was written.

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Editorial

NO TIME FOR GOOFING . . .

Complete Utilization of Manpower a Must For Efficient Fertilizer Plant Operation

PRODUCTION PROBLEMS in plants making fertilizers and pesticidal chemical products are not entirely confined to things mechanical, according to comments we receive from time to time from plant superintendents and heads of companies in this business.

A major portion of management's responsibility lies in keeping production going as efficiently as possible, and that means not only seeing that machinery is well-oiled and running smoothly, but also keeping the operators on the ball and making sure that little time is lost.

Time is an elusive thing, hard to describe and impossible to retrieve once it is gone. The attitudes toward working time from the viewpoint of the superintendent and of the hourly worker may be entirely different animals. The harried manager, faced with production schedules and pressures from all sides, may remark: "There just aren't enough hours in the day," but the fellow wielding a shovel or filling bags will look longingly at the clock every few minutes and think: "This day sure is dragging."

Is there any way to improve this latter attitude? Undoubtedly numerous superintendents and heads of companies have puzzled about this question many times, perhaps without much luck at arriving at a solution. Coffee breaks? Coke breaks? Opinion is divided on whether such interruptions in the working schedule are compensated for by increased output, but they seem to be regarded as a necessary "benefit."

With wage scales continually moving upward, consideration of how the time spent in working might be utilized more fully is of unusual importance. Wages constitute a major portion of the annual budget of most companies, so the many little dissipations of time on the part of workers begin to add up to a substantial figure over the period of a few months or a season.

Probably all this is one of the logical reasons for the current swing toward mechanization wherever possible. Nearly every plant manager we have talked with recently has indicated that his company either has already installed a certain degree of automation in the plant, or is considering doing so.

This is no particular reflection on the plant workmen, especially those who do possess healthy work attitudes. Rather, it is a visible indication of the tightening up of economic forces . . . the pressure of competition where the inefficient plant loses ground steadily . . . the unmistakable hint that without improvement in productivity, any firm is being slowly strangled.

Farmers are urged to purchase and

use fertilizers generously in order to cut their unit cost of production. It costs about the same to prepare the ground, buy and plant seeds, cultivate and harvest crops from two given fields. But if the farmer invests a relatively small amount in fertilizers of the right type, he will realize a profit far beyond the added cost of the plant food he has applied. He makes more because he is able to grow more bushels, tons, or bales of a crop on the same amount of ground with the same fixed costs that would still be there even if his yield were much less.

Yet, the very fertilizer plant from which this profit-making plant food comes may be operated in a manner contrary to the principles applied by its customers. Unit costs still remain high in many plants. Why?

One good starting point is to check on some of the factors mentioned above . . . are the men in the plant putting in their hours efficiently? Are they provided with adequate tools to do their job better . . . such tools including mechanical shovels and loaders, fast and accurate weighing and bag-filling devices . . . efficient dust-catchers and other means to prevent the loss of materials through their drifting away?

For good or ill, modern competitive pressures demand more efficiency in the plant making either pesticides or fertilizers. It is not always comfortable to keep abreast of advancement in the manufacturing end of the trade, but neither is it healthy to allow one's operations to lag behind.

Avoid Hint of "Air Poisoning" . . .

MOST CHEMICAL PLANT operators are very much aware of the value of creating a good image of themselves in the eyes of the community where the plant operates. Citizens are too often prone to view the fertilizer or pesticide plant as a hazard to health due to fumes and smoke, and in the event of a breakdown or accident which allows an unusual volume of odor or smoke to escape, these people tend to become panicky.

In a recent incident in Toledo, Ohio, sulphur trioxide fumes got into the atmosphere due to a break in the acid line and faulty operation of a pump. Neighbors coughed, sneezed, called the sheriff, city officials and police for help. Actually, the incident was minor and endangered nobody.

But it does indicate the consternation caused by even the slightest hint of "poisoning" the air. The best defense is keeping everything under control at all times. Easy to say, but sometimes difficult to accomplish. Modern plant equipment will go a long way toward diminishing the threat of unwanted incidents.



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CROPLIFE is a controlled circulation journal published weekly. Weekly distribution of each issue is made to the fertilizer manufacturers, pesticide formulators and basic chemical manufacturers. In addition, the dealer-distributor-farm adviser segment of the agricultural chemical industry is covered on a regional (crop area) basis with a mailing schedule which covers consecutively, one each week, three geographic regions (South, Midwest and West) of the U.S. On the fourth week, production personnel in fertilizer manufacturing and pesticide formulating plants throughout the U.S. are covered in depth. To those not eligible for this controlled distribution, Croplife's subscription rate is \$5 for one year (\$8 a year outside the U.S.). Single copy price 25¢.

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PARATHION

Continued from page 2

larvae, *Aedes aegypti*, after one hour of exposure. A rapid bioassay method for methyl parathion has been developed from these observations. Replicated sample populations of two-day-old mosquito larvae are added to standard methyl parathion diluted to 1 ppm and unknown samples of methyl parathion. At the end of one hour the average percent mortality is determined by averaging the mortality data from each replicate population. By comparing the LD₅₀ of the unknown with the LD₅₀ of the standard sample, the percentage of active methyl parathion can be determined. These values are converted to values suitable for plotting as a function of time versus concentration in the experimental solution. The half life is then obtained by observation.

Comparative bioassay data on unstabilized and stabilized methyl parathion stored at room temperature and

at 50° C. (122° F.) is shown in Figures 2 and 3.

Additional evidence for the lack of extended field life was obtained from cotton test plots in Central America. Plots were treated with single applications of three formulations of a 2.5% dust containing 240%, 80% and 40% of stabilizer, respectively, based on the methyl parathion. A standard 2.5% methyl parathion dust was applied as a control and an untreated check plot was maintained for comparison.

The rapid build-up of the weevil count after treatment indicated no apparent change in normal residual life of the formulation. The characteristic high rate of kill indicated that the formulation was normal with respect to field performance. In these tests there was no indication of phytotoxicity.

Greenhouse tests with stabilized methyl parathion dusts have also shown no evidence of phytotoxicity.

Staff Assistant's Appointment Announced

NEW YORK—West Virginia Pulp & Paper Co. has appointed Shelton J. Jones to the position of staff assistant to Allan Woodruff, manager of the company's St. Louis, Mo., plant, it has been announced by Sheldon Y. Carnes, regional manager, multiwall division.

In his new position Mr. Jones will be responsible for the safety and personnel development programs at the St. Louis plant as well as for the selection and training of employees.

Mr. Jones joined the company in 1952 and for several years worked on the development of Kraftman Clupak extensible paper at the company's Charleston, S.C., mill. He is a graduate of Clemson College and has taken advanced courses at The Citadel.

Classified Ads

Classified advertisements accepted until Tuesday each week for the issue of the following Monday.

Rates: 15c per word; minimum charge \$2.25. Situations wanted, 10c a word; \$1.50 minimum. Count six words of signature, whether for direct reply or keyed card this office. If advertisement is keyed, care of this office, 20c per insertion additional charged for forwarding replies. Commercial advertising not accepted in classified advertising department. Display advertising accepted for insertion at minimum rate of \$11 per column inch.

All Want Ads cash with order.

HELP WANTED

FERTILIZER PLANT WORKING FOREMAN take full charge small plant, control of production, mixing, shipping, etc.; complete plant maintenance. Salary commensurate with experience. Plant located central Atlantic state. Address Ad No. 4987, Croplife, Minneapolis 40, Minn.

FIELD BIOLOGIST — OPENING EXISTS for qualified scientist to conduct field evaluations of pesticides, including test plot work and making experiment station contacts. Graduate training and 1-5 years' field experience in fungicidal, herbicidal and insecticidal evaluation are desirable. Submit brief resume of training and experience, noting salary requirements to: Director of Research and Development, Niagara Chemical Division, Middleport, N. Y.

TECHNICAL SALES REPRESENTATIVE

Aggressive individual, age 25-35, to handle sales contacts in Southeast or Midwest area; also service experimental stations. Must have degree in Agriculture. Excellent opportunity to join staff of well-established basic agricultural chemical manufacturer. Send detailed resume and salary requirements to Velsicol Chemical Corp., 330 East Grand Ave., Chicago 11, Ill., attn: Sales Mgr. Agricultural Chem. Div. All replies held strictly confidential.

ASSISTANT SALES MANAGER

Responsible growth position for man with degree in Agriculture or equivalent. Must have at least three years' business experience, preferably in Market Survey and Merchandising capacity. Must be interested in Sales, and Sales Problems, Merchandising and Promotion Programs. Ability to work with manufacturers' representatives and to develop merchandising programs in agriculture and home garden supply fields necessary.

Please send resume and salary requirements to Ad No. 5023, Croplife, Minneapolis 40, Minn.

BUSINESS OPPORTUNITIES

U.S. COURT SALE NICHOLS FARM FERTILIZER PLANT & INVENTORY

AUGUST 10, 1959 OKLAHOMA CITY, OKLA.

Complete fertilizer manufacturing facilities with approximately 15-acre industrial site and truckage, large A-frame storage building, continuous T.V.A. type granulation unit, truck loading docks, warehouses, superphosphate plant and air-conditioned offices.

Annual capacity estimated at 50,000 tons of pelleted fertilizer. Makes all grades up to 13-39-0. Can produce 25,000 tons of superphosphate yearly. Inventory consists of raw materials, mixed and semi-processed fertilizers and empty fertilizer bags.

Plant serves all Oklahoma, parts of Arkansas, Missouri, Kansas and Texas. Well located southwest of Oklahoma City, Oklahoma, on State Highway 152. New irrigated areas assure increased consumption of fertilizers. Researchers estimate state farmers' needs at 800,000 tons yearly.

The Court authorized this sale under Chapter XI of the Act relating to Bankruptcies. Sealed bids must be filed in the Clerk's office by 11:00 A.M., August 10, 1959, and will be opened at 2:00 P.M. of the same day. All bids subject to approval of Court. For complete details contact Clerk, United States District Court for the Western District of Oklahoma, Federal Building, Oklahoma City, Oklahoma, or Nichols Seed & Fertilizer Co., Debtor in Possession under Chapter XI, P.O. Box 1296 — CE 9-1341 — Oklahoma City, Oklahoma.

SALES AND EARNINGS

ST. LOUIS—Monsanto Chemical Co.'s consolidated sales and earnings for the first six months of 1959 reached \$413,708,000 compared to \$337,275,000 for the same period last year. Net earnings from such consolidated sales were \$33,759,000, an increase of 102% over earnings of \$16,741,000 for the first six months of 1958.

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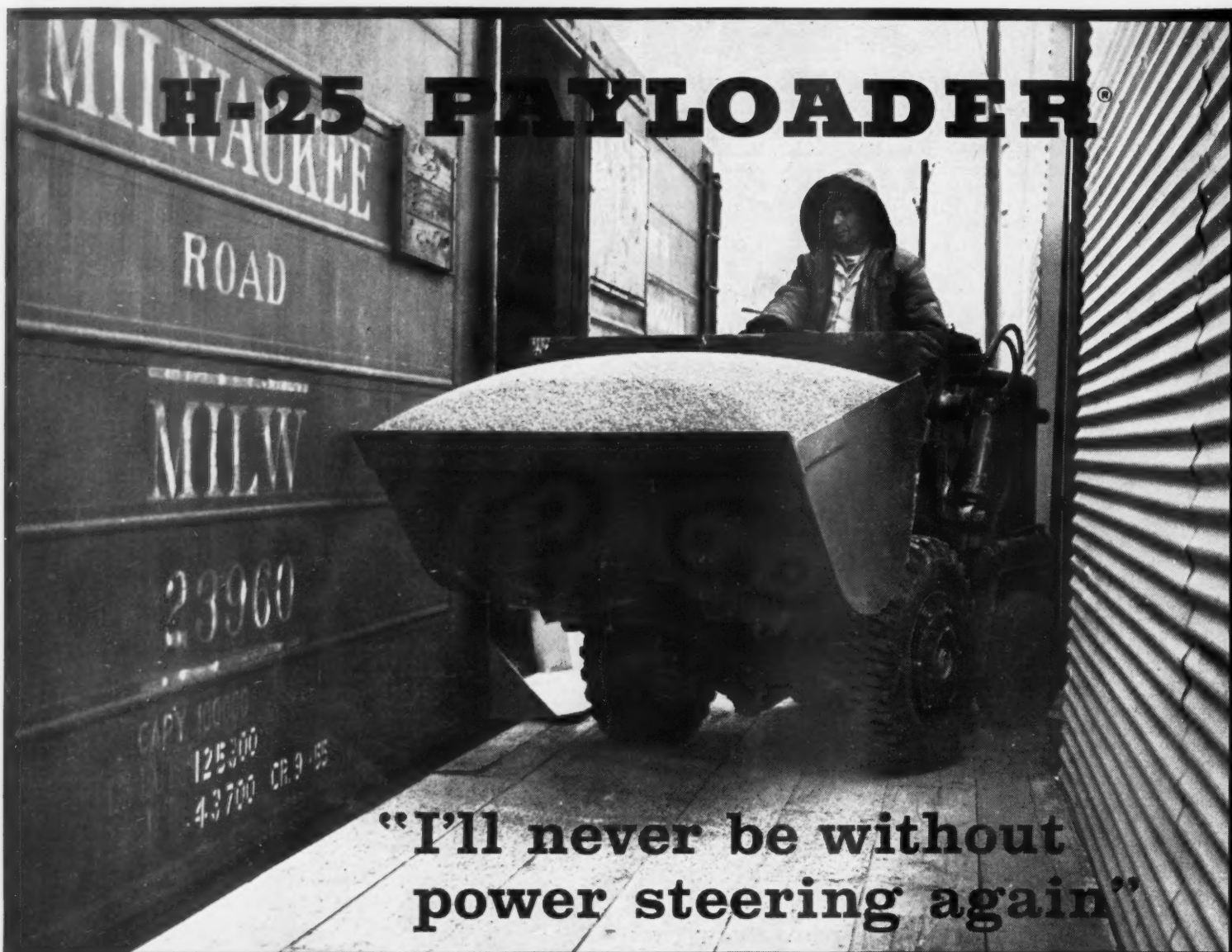


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AUGUST							SEPTEMBER							OCTOBER							NOVEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
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30	31																										
DECEMBER							JANUARY							FEBRUARY							MARCH						
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power steering again"**

"There's no exertion and lots more maneuverability with the power-steering. It's simpler, also faster loading and getting in and out," adds Roy Forman of Lee County Service Co. of Amboy, Ill.

Whether you are doing rail car unloading or any other kind of bulk handling, the power-steer and power-shift features of the Model H-25 "PAYLOADER" spell ease of operation and fast maneuvering that move more tonnage per shift.

This outstanding tractor-shovel also boasts the most thorough protection against dust and dirt—a triple air cleaner system, cartridge type oil filters on all three oil systems, and grease and oil seals at all strategic joints.

Other proven "PAYLOADER" models are also available, from 2,000 to 12,000 lbs. carry capacities, to meet your every material handling need. Your Hough Distributor is ready to serve you. See him today.

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The H-25 with 2,500 lb. carry capacity, only 6 ft. turning radius and easy power steering, is the most concentrated package of tractor-shovel productivity ever designed. Power-shift transmission with two speeds forward and reverse, power-transfer "no-spin" differential, and 4,500 lbs. of bucket break-out force are other outstanding features that speed production and reduce operator effort.

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